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THE EFFECTS OF TAPED RELAXATION TRAINING ON PHYSIOLOGICAL  
EVENTS AND HOME AND CLASSROOM BEHAVIOR  
OF HYPERACTIVE CHILDREN

by

Phyllis L. Cole

A dissertation submitted in partial fulfillment  
of the requirements for the degree

of

DOCTOR OF PHILOSOPHY

in

Psychology

UTAH STATE UNIVERSITY  
Logan, Utah

1980





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Phyllis L. Cole

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## ABSTRACT

# The Effects of Taped Relaxation Training on Physiological Events and Home and Classroom Behavior of Hyperactive Children

by

Phyllis L. Cole, Doctor of Philosophy

Utah State University, 1980

Major Professor: Dr. Sebastian Striefel

Department: Psychology

A multiple baseline design across subjects was employed to study the effects of taped relaxation training on frontalis EMG, EEG alpha and theta activity, finger skin temperature, and classroom and home behavior (Experiment I) of three male elementary school children identified as hyperactive by their classroom teachers and parents on behavior rating scales for hyperactivity. The three subjects ranged in age from 5 years 10 months to 7 years 9 months, with a mean age of 6 years 8 months. Four physiological variables of the subjects were monitored during daily sessions from Monday to Friday in a laboratory setting. After participating in a minimum number of baseline sessions (4, 8, 12) and meeting a stability criterion for frontalis EMG, the



subjects were provided taped relaxation training. Subjects participated in a minimum of eight taped relaxation training sessions and were required to meet a termination frontalis EMG stability criterion before relaxation training was discontinued. Subject 1 participated in eleven sessions of taped relaxation training and both Subjects 2 and 3 participated in ten sessions of taped relaxation training. Classroom and home observational data were obtained throughout the experiment for each of the three subjects. No overall effects were found for the reduction of physiological tension as a result of relaxation training for these three subjects, nor were decreases observed in hyperactivity in the classroom and home settings. Three male elementary children identified as hyperactive by their classroom teachers and parents on behavioral rating scales for hyperactivity participated in Experiment II. This experiment employed the same multiple baseline design used in Experiment I. The subjects in Experiment II ranged in age from 7 years 6 months to 10 years 5 months, with a mean age of 8 years 5 months. Experiment II was conducted to determine the effects of a backwards tape presentation of the relaxation training tape used in Experiment I on frontalis EMG, EEG alpha and theta activity, finger skin temperature, and classroom and home hyperactive behavior. Subjects attended daily sessions from Monday to Friday in a laboratory setting where they were monitored on the physiological variables. After

participating in a minimum number of baseline sessions (4, 8, 12) and meeting a stability criterion for frontalis EMG, the subjects participated in eight sessions of the backwards tape presentation. Subjects were then provided with the taped relaxation training used in Experiment I, for a minimum of eight sessions, or until reaching a stability criterion on frontalis EMG for termination; all three subjects participated in nine taped relaxation training sessions. Throughout the study, classroom and home behavioral observations were conducted for these three subjects. No systematic effects were found for the reduction of physiological tension or for decreased hyperactivity in the home or classroom settings as a result of either the backwards tape presentations or the taped relaxation training.

(141 pages)

## INTRODUCTION

It has been estimated that 3% to 20% of school age children in the United States display hyperactive behavior to such a degree that they are socially and academically impaired (Eisenberg, 1972; Federal Involvement Report, 1970; Huessey, 1967; Prechtl & Stemmer, 1962; Report on Conference by HEW, 1971; Stewart, Pitts, Craig, & Dieruf, 1966). Referral data from child guidance and mental health clinics indicate that hyperactivity is one of the most common referral problems in the United States (MacKeith, 1974; Patterson, Jones, Whittier, & Wright, 1965); child mental health referrals (Langhorne, Loney, Paternite, & Bechtoldt, 1976). The prevalence of hyperactivity is reported to be higher for male children than for female children by 5:1 (Cantwell, 1975).

The most favored treatment for hyperactivity has involved the use of prescribed medication, particularly the use of a variety of stimulant drugs. Although this treatment approach has been medically sanctioned for over 25 years (Grinspoon & Singer, 1973), it provoked a nation-wide controversy in recent years (Federal Involvement Report, 1970; Report on Conference by HEW, 1971) for several reasons:

- 1) the potential harmful side effects to some children;
- 2) concern that prescribed drug medication at early ages could

lead to psychological or physical reliance on drug intake at later ages, particularly in the adolescent years; 3) indiscriminate medication prescriptions given to parents for children without appropriate assessments of hyperactivity; 4) lack of medical supervision on the usage of stimulant drugs. Concerns voiced in the early 1970s about the use of stimulant drugs for hyperactivity led to several careful surveys on the prevalence of hyperactive children in the United States and on the percentage of these children receiving stimulant drugs (Weiss & Hechtman, 1979).

For many children under medical supervision, stimulant medication has been shown to be a successful treatment approach for hyperactivity with few reports of adverse side effects (Cantwell, 1975). However, there are some children whose hyperactive behavior does not improve as a result of stimulant medication (Cantwell, 1979); estimates of frequency of positive responding reported in the literature range from 30% to 70% (Ross & Ross, 1976).

Another approach to the control of hyperactive child behavior has been through the application of behavioral intervention techniques, particularly techniques involving reinforcement procedures and using adults or peers to monitor and manage contingencies. A number of published reports indicate success in the control of hyperactive behaviors utilizing a variety of behavior treatment programs (Allen, Henkel, Harris, Baer, & Reynolds, 1967; Allyon, Layman, & Kandel,

1975; Doubros & Daniels, 1966); Homme, DeBaca, Devine, Steinhorst, & Rickert, 1963; Novack, 1971; Patterson et al., 1965; Pihl, 1967; Twardosz & Sajvaj, 1972). Although these authors reported behavioral intervention as highly effective, there has been some concern expressed about the number of short-term studies that have focused on isolated behaviors and the paucity of long-term studies (Ross & Ross, 1976).

Other investigators have advocated self-control strategies as a desirable means of producing behavior change and increasing generalization of change effects (Bandura, 1969; Franks & Wilson, 1974; Goldfried & Merbaum, 1974; Kanfer & Karoly, 1972; Kanfer & Phillips, 1970; Thoreson & Mahoney, 1974). In 1975, Douglas and associates developed a cognitive approach to be used with hyperactive children that involved training of self-verbalization skills to be used in the self-control of impulsive tendencies. In a follow-up study (Douglas, Parry, Marton, & Garson, 1976), it was reported that self-verbalization, modeling, and self-reinforcement training with hyperactive boys resulted in limited improvement on cognitive and motor tasks; these investigators found no changes in teacher ratings of hyperactive behavior. Further research is needed to determine the effectiveness and clinical utility of this treatment approach for hyperactivity.

In an unpublished report (Braud, 1975), it was proposed that children exhibiting hyperactive behavior were physiologically tense. Braud further reported that the results of several pilot studies (Braud, 1975, unpublished report; Braud, Lupin, & Braud, 1975; Lupin, Braud, Braud, & Duer, 1974, unpublished report), which explored the use of progressive relaxation training and EMG biofeedback, indicated that the reduction of physiological tension resulted in the control of hyperactive behavior in home and classroom settings. Except for the reports by Braud and associates, there appeared to be no other investigators using relaxation training with hyperactive children. However, it had been reported (Alexander, Miklich, & Hershkoff, 1972) that systematic relaxation training provided to asthmatic children had resulted in successful self-control of respiration. Additionally, relaxation training had been demonstrated to be a useful technique with adults in the modification or control of a variety of physiological problems, i.e., tension and migraine headaches, blood pressure, asthma (Brown, 1977; Budzynski & Stoyva, 1969; Lawrence, 1972).

#### Statement of the Problem

One of the major goals in the use of stimulant drug treatment for hyperactivity has been to produce a relaxed physical state. Bradley (1950) referred to a "calming effect" that amphetamines produced in children labeled as

hyperactive. This "calming effect" appeared to Bradley to be correlated with an increase in voluntary control of overt behavior and a decrease in activity level of the hyperactive children. Bradley also reported that some of the children taking amphetamines became "distinctly subdued in their emotional responses . . .," demonstrated by less extreme mood swings, heightened interest and alertness in their environmental surroundings, and more adaptability to adult control (Bradley, 1937).

A direct relationship between physiological and mental-emotional changes has been hypothesized as a "psychophysiological principle" (Green, Green, & Walters, 1970). This hypothesized principle suggests that changes in physiological states occur concurrently with changes in mental-emotional states and vice versa. It has been assumed that changes in the behavior of children labeled hyperactive have occurred as a result of changes in physiological states from stimulant drugs (Bradley, 1950). If so, a reduction in physiological tension through relaxation training could affect levels of hyperactive behavior. If hyperactive children could be taught relaxation techniques, and, thereby, produce their own "calming effects," it may be that they could then demonstrate self-control of their behavior in their natural environments. This appears to have been the underlying rationale in the pilot work by Braud and

associates (Braud, 1975, unpublished report; Lupin, Braud, Braud, & Duer, 1974, unpublished report).

A number of problems in the pilot work of Braud and associates prevent a conclusive interpretation of findings. First, there were no physiological measures of subject tension levels obtained on subjects receiving relaxation training. Second, relaxation training was provided by cassette tapes given to parents for use by subjects in their homes, and the investigators had to rely on parent report of the use of the tapes; it was assumed that all subjects participated in the same number of training sessions. Third, the home-based training took place in different settings under different conditions, which may have influenced reported results. Fourth, observations of defined hyperactive behaviors were conducted prior to and after training, but not during the relaxation training period. Fifth, the pilot studies did not use control groups or a controlled single subject design. Finally, there were six different tapes used in the relaxation training program, i.e., relaxation training instructional tapes, visual imagery and sound effects tapes, a positive attitude instruction tape. These tapes could be used selectively by parents and subjects so relaxation training effects were confounded by possible effects of the other tapes.

In summary, there is a need for a controlled study to determine the physiological effects of relaxation training



with hyperactive children and to ascertain if the effects of such training modify hyperactive behaviors exhibited in natural settings.

### Purpose

This study was designed to determine:

1. Whether cassette taped relaxation training would result in reduced levels of physiological tension for children who were identified as hyperactive.
2. Whether the backwards presentation of a relaxation training cassette tape would result in reduced levels of physiological tension for children who were identified as hyperactive.
3. Whether hyperactive behavior exhibited in classroom and home settings by children identified as hyperactive would be decreased as a result of cassette taped relaxation training or backwards presentation of the relaxation training tape.

## REVIEW OF RELATED LITERATURE

The review of literature which follows is intended to provide the reader with a brief overview of hyperactivity and various approaches used in the treatment of hyperactivity and related issues. The treatment approaches to be discussed will include: stimulant and other medication, behavioral intervention, and relaxation training. This review does not include discussions of other pertinent issues in the area of hyperactivity (i.e., etiology).

### Background

The terms "hyperactivity", "hyperkinetic", or "hyperkinetic behavior syndrome" have been used to describe child behavior characterized by excessive motor activity, brief attention span, distractibility, impulsivity, and irritability (Burks, 1960; Laufer & Denhoff, 1957; Luszki, 1968; Spring, Greenberg, Scott, & Hopwood, 1974; Stewart et al., 1966; Wender, 1973). Although there is some disagreement about using these terms synonymously (Bax, 1972; MacKeith, 1974; Wade, 1973), the terms are often considered to be interchangeable even though there may be distinct preferences for the use of one term over another. Educators, parents, and psychological researchers seem inclined to use

the term "hyperactivity" when describing child problems involving the behaviors listed above (Cohen & Douglas, 1972; Mendelson, Johnson, & Stewart, 1971; Patterson et al., 1965; Satterfield & Dawson, 1971; Wender, 1973; Werry & Sprague, 1970), while physicians and medical researchers seem to more frequently use the terms relating to hyperkinesis (Conners, Rothschild, Eisenberg, Schwarts, & Robinson, 1969; Eisenberg, 1972; Fish, 1971; Grinspoon & Singer, 1973; Huessey, 1967; Millichap, Aymat, Sturgis, Larsen, & Egan, 1968). The term "attentional deficit disorder (ADD)" has been introduced in recent years, and replaces the term "hyperactivity" in the American Psychiatric Association's official Diagnostic and Statistical Manual of Mental Disorders (DSM III). Cantwell (1979) has indicated that this change in terms is appropriate since recent research indicates that the primary problem in hyperactive individuals is that of attentional deficits. In this paper, however, the terms "hyperactivity" and "hyperactive" will be used to describe the population of interest.

Children labeled as hyperactive typically display idiosyncratic patterns and intensities of behaviors considered to be reflective of hyperactivity, i.e., impulsivity, attentional deficit, distractibility (Cantwell, 1975; Conners, 1966; Marwit & Stenner, 1972; Routh & Roberts, 1972; Wade, 1973; Weithorn, 1973). Most of these children usually display a number of the hyperactive behaviors to a degree

that is considered aversive by adults or peers (Grinspoon & Singer, 1973; Patterson et al., 1965).

There is no present consensus regarding the etiology of hyperactivity (Cantwell, 1979; Grinspoon & Singer, 1973; Weithorn, 1973), but there is general agreement that the prevalence of this childhood behavior disorder warrants concern (Federal Involvement Report, 1970; Grinspoon & Singer, 1973; Report on Conference by HEW, 1971).

Professional interest in hyperactivity as a childhood problem developed shortly after World War I when it was found that a number of children who had experienced encephalitis later displayed similar manifestations of hyperactive behaviors (Grinspoon & Singer, 1973; Wender, 1972). In the 1940s, it was reported (Strauss & Lehtinen, 1947) that children who had sustained severe head injuries or suffered anoxia frequently exhibited hyperactive behaviors similar to those exhibited by the children who had experienced encephalitis. During this same period of time, other investigators reported observing the same phenomenon in children who had no known history of severe illness, injury, or observable brain damage (Grinspoon & Singer, 1973; Kahn & Cohen, 1934). Laufer and Denhoff (1957) discussed the "hyperkinetic impulse disorder," delineating some general behavioral areas that are subsumed now under the hyperactivity or hyperkinetic terms. In the last 35 years, the major research thrusts in the area of hyperactivity have been

directed toward attempts to determine the etiology of hyperactive behavior and to assess the efficacy of treatment approaches, particularly stimulant drug treatment (Grinspoon & Singer, 1973).

### Treatment Approaches and Related Issues

#### Stimulant Medication

The first use of stimulant medication for hyperactivity was reported by a physician (Bradley, 1937, 1950), and influenced the subsequent use of stimulant medication as a treatment approach for the control of hyperactivity. Since Bradley's first reports, many research studies have supported the efficacy of stimulant medication for the hyperactive child (Conners et al., 1969; Conners & Eisenberg, 1963; Denhoff, Davids, & Hawkings, 1971; Eisenberg, Conners, & Sharpe, 1965; Epstein, Lasagna, Conners, & Rodriguez, 1968). Grinspoon and Singer (1973) have criticized some of the studies conducted in the early 1960s on the ground of methodological inadequacies (i.e., no placebo controls, biased subject samples), and they claim that findings from these studies are inconclusive and contradictory regarding stimulant drug treatment efficacy for hyperactivity. It has been reported more recently, however, that a number of well-designed studies were conducted in the late 1960s and early 1970s that clearly indicate the effectiveness of

stimulant medication for hyperactivity for about 70 percent of children given the medication (Cantwell, 1979; Weiss & Hechtman, 1979).

Reports of adverse side effects from stimulant drugs (Bakwin, 1948; Eveloff, 1968; Levy, 1966; Mattson & Calverley, 1968; Ney, 1967; Safer & Allen, 1973) began to be published along with reports on stimulant medication effectiveness. It has been reported recently (Barkley, 1977; Cantwell, 1979; Weiss & Hechtman, 1979) that short-term side effects (i.e., insomnia, decreased appetite with subsequent weight loss, abdominal pain, headaches, depression, irritability) of stimulant drugs are seen in a minority of children. Follow-up studies on long-term side effects are lacking (Cantwell & Carlson, 1978). Early investigators reported concerns about possible growth suppression as a side effect of stimulant medication (Safer & Allen, 1973). However, recent studies seem to indicate that growth suppression is a temporary side effect and is counteracted by rapid growth when medication is discontinued (McNutt, Boileau, & Cohen, 1977) or in the second year of medication usage (Satterfield, Cantwell, Schell, & Blaschke, 1979).

Other potential disadvantages of the use of stimulant drugs for hyperactivity are not yet resolved, i.e., the indiscriminate prescribing of stimulant drugs based on parent or teacher reports, the problem of medically unsupervised stimulant drug usage, the potential for drug abuse in

adolescent or adult years by early users of stimulant drugs. A major disadvantage in stimulant medication treatment for hyperactivity is that it does not impact on long-term problems, particularly in the academic and social areas (Barkley, 1977).

#### Non-stimulant Medication, Diets, and Vitamins

A variety of other approaches to the treatment of hyperactivity also have limitations. Substitute drugs for stimulant drugs have possible adverse side effects, e.g., imipramine (Brown, Winsberg, Bialer, & Press, 1973), or may be less effective in decreasing hyperactivity, e.g., chlorpromazine, thioridazine (Weiss & Hechtman, 1979). According to Cantwell (1979), claims for positive effects on hyperactivity through additive-free diets, megavitamin therapy, and hypoglycemic diets have not been documented by well-controlled studies.

#### Behavioral Intervention

In an extensive review, Mash and Dalby (1979) have discussed numerous behavioral intervention studies designed for the treatment of hyperactivity. Mash and Dalby have stated that the assessment of the potential benefit of a variety of behavioral interventions (i.e., reinforcement procedures) with hyperactive children is inconclusive because of limitations in many of the studies reviewed (i.e., small numbers of subjects, inadequate subject selection criteria, lack of

concern for situational context variables, confounding of treatments), and because many relevant studies have not been done (i.e., generality of effects across time and settings, isolating specific components of intervention responsible for positive changes in behavior, exploration of parental attitudes toward behavior deviancy, parent training, long-term effects, hyperactive child attributional systems). O'Leary (1977) has also reported on methodological problems (i.e., dependent measures not specific to hyperactivity or sensitive to drug treatment) found in a number of studies reported in the literature utilizing behavioral intervention programs for control of hyperactive behavior.

#### Combined Stimulant Medication and Behavioral Intervention

Based on the results of several studies, O'Leary (1980) has suggested that there may be occasions when a combination of behavioral interventions and stimulant medication would be appropriate, or would enhance treatment effects for hyperactivity. However, in a guarded conclusion, Gittelman-Klein, Klein, Abikoff, Katz, Gloisten, & Kates (1976) reported that medication treatment for hyperactivity was as effective as a combined medication-behavioral intervention treatment, and both treatments were more effective than behavioral intervention alone. Mash and Dalby (1979) caution that conclusions about a treatment approach combining medication with behavioral interventions are premature since neither



medication nor behavioral interventions are unitary treatments, and empirical information is needed in both areas before attempting to draw conclusions.

#### EMG Biofeedback and Relaxation Training

In 1975, Braud et al. found that EMG feedback resulted in a reduction of frontalis muscle tension for one subject, with a concurrent decrease in hyperactivity. In other pilot studies, Braud and associates (Braud, 1975, unpublished report; Lupin et al., 1974, unpublished report) found that relaxation training resulted in improvement in hyperactivity in children. It was implied that the improvement in hyperactivity was due to decreased muscular tension brought about through relaxation training although muscle tension changes were not monitored by EMG equipment.

A number of adult studies have utilized electromyograph (EMG) recordings of frontalis muscle activity as an indication of general physiological tension (Brown, 1977; Stoyva & Budzynski, 1974). In 1976, Basmajian discussed the use of electromyograph monitoring of the frontalis muscle and concluded that recordings of frontalis EMG could be considered rough indicators of relaxation training progress. Other indices of physiological functions have been purported to be indicators of physiological tension. Green and associates (Green, 1973; Green et al., 1970) have demonstrated the relationship between relaxation and temperature rise in

adults, using finger skin temperature; finger skin temperatures of 90° Fahrenheit or higher have been considered to be indicative of autonomic relaxation. EEG alpha (8-13 Hertz) and theta (4-7 Hertz) brain wave activity have been used in a number of studies with adults to indicate levels of relaxation or of physiological tension (Brown, 1977). Monitoring of these three indicators of physiological tension (EMG, EEG alpha, and finger skin temperature) during relaxation training could allow an empirical conclusion to be drawn about the effectiveness of that training on physiological tension levels.

#### Summary

In summary, there are limitations to all of the treatment approaches for hyperactivity that have been reviewed, but the major limitation for the relaxation training approach is the lack of research to support the effectiveness of this approach. Therefore, this treatment option needs to be explored further before being considered as a viable treatment alternative for hyperactivity.

## METHOD

### Subjects

Nine male students were referred by teachers from a local school district because of hyperactive behaviors that were being exhibited in their classrooms. The referring teachers completed behavioral rating scales for hyperactivity (see Appendix A) for each of the students they referred. Each of the teacher-rated students received behavioral ratings which met an experimenter selected criterion rating (to be explained later) that was required for participation in the study. Two of the nine referred students were receiving medication for hyperactivity at the time of referral. These students were excluded from participating in the present study to avoid confounding any treatment effects that might be found with the medication factor. Although two of the remaining seven students were not taking medication for hyperactivity at the time of referral, they had taken medication for hyperactivity at other times. One of these students had been diagnosed as hyperactive by a physician; the second student and one other student had been diagnosed by physicians as having hyperactive tendencies.

Parents of the seven remaining students were asked to rate their children on the behavioral rating scale for

hyperactivity (see Appendix A); all parent ratings met the experimenter selected criterion rating. The six students who received the highest combined parent/teacher ratings were selected to participate in the study. When the study began, these subjects ranged in age from 5 years 10 months to 10 years 5 months, with a mean age of 7 years 7 months.

Before the study began, a letter was sent to the parents of each subject describing the project and signed parent consent forms were obtained for all subjects (see Appendix B). Approval to conduct this study was given by members of the Human Subjects Research Committee at Utah State University.

### Experimental Setting

The study was conducted in a laboratory area located within the Exceptional Child Center at Utah State University. The laboratory area was divided into two rooms, the inner room contained a reclining lounge chair, a small table, a portable cassette tape recorder, and sensor apparatus. The wires of the sensor apparatus were connected to physiological monitoring equipment located in the second, or outer, room of the laboratory area. The inner and outer rooms of the laboratory area were separated by a sound-proofed wall containing one-way observation window which allowed observations to be made from the outer room to the inner room.

### Design

A multiple baseline design across subjects (Baer, Wolf, & Risley, 1968; Hersen & Barlow, 1976) with replication was used in Experiment I for three subjects who received taped relaxation training, and in Experiment II for three subjects who received the relaxation training tape played backwards (see Appendix C). The multiple baseline design requires that the dependent variables be recorded for all subjects included in the study during each session of baseline and treatment conditions. Additionally, treatment conditions are introduced to subjects sequentially at different points in time during baseline; thus, allowing a sequential demonstration of treatment effects for each subject while controlling for the effects of time, baseline conditions, or other extraneous variables (i.e., placebo effects). The dependent variables recorded in this study were: EMG frontalis muscle activity, finger skin temperature, EEG percent of alpha and theta activity, and percent of intervals in which specified behaviors were observed in the classroom and home settings.

The multiple baseline design employed in this study had additional advantages to those already indicated. It was possible to include a small number of subjects in the study, and the empirical data obtained for single subjects has particular relevance for clinicians who typically work with individuals.

The subjects included in these experiments were ranked according to the average behavioral rating score received, and were matched as closely as possible into pairs; the two highest ranked subjects were paired, the next two highest ranked subjects were paired, and the two lowest ranked subjects were paired. Subject pairs were then randomly assigned to each experimenter in order to ensure that the subjects participating in each experiment were fairly well matched in terms of behavioral rating scores. The three subjects in each experiment were then randomly assigned to different baseline conditions. The subjects in Experiment II were provided with the same taped relaxation training provided to the subjects in Experiment I following eight sessions of the backwards tape presentation.

#### Instrumentation and Data

An Autogenic Systems Inc. Feedback Myograph, Model 1100, was used to monitor frontalis muscle activity. The percent of EEG alpha activity (8-12 Hertz) and the percent of EEG theta activity (4-8 Hertz) were monitored by an Autogenic Systems Inc. Feedback Encephalograph, Model 120a. An Autogenic Systems Inc. Feedback Temperature Unit, Model 1000, was used to monitor finger skin temperature. Feedback from these biofeedback instruments was not provided during these experiments; rather, the instruments were used to monitor physiological data. Each piece of equipment

contained a front panel meter which provided visual displays of the inputs received from the electrodes and thermister that were attached to the subject in the adjacent room.

A portable cassette tape recorder was located in the inner room of the laboratory area, placed on a small table out of reach of the subjects. The tape recorder remained in the room for all sessions, and was kept turned off except during treatment sessions when it was turned on by the experimenter or an adult assistant; no earphones were used during the study.

Nine specified behaviors of interest (see Appendix E) were observed in home and classroom settings by trained observers. These behaviors were selected for observation because they appeared most frequently on behavior checklists or rating scales used in studies of hyperactive children (Denhoff et al., 1971; Conners, 1969; Davids, 1971; Werry & Quay, 1969). Some behavioral descriptors were modified in an attempt to clarify definitions for observers. The first observations of each subject were made during the same week that the subject began participating in the laboratory sessions. Observational data were recorded on behavioral observation data sheets (see Appendix F). Classroom and home observations were conducted for 25 minute time periods at times convenient to parents and teachers with the restriction that the ongoing activities would allow for observation and opportunities for the children to engage in the

hyperactive behaviors of interest. An interval time schedule was employed, using 10 second observation intervals interspersed with 5 second recording intervals. In order to standardize the behavior recording procedure, observers wore an ear plug which was connected to a portable cassette tape recorder, and were informed by a pre-recorded cassette tape when to observe and when to record.

The behavior rating scale used by referring teachers and parents to identify children for this study (see Appendix A) was a modified form of an instrument that had been used in a number of studies to identify hyperactive children (Davids, 1971; Denhoff et al., 1971). Davids (1971) has reported that adequate reliability and clinical utility of his rating scale were established in several unpublished studies. The modified scale consists of eight global behavioral categories and six intensity level response choices for each category of behavior; six global categories were retained from the seven in the original scale and two categories were added to include behaviors that were to be directly observed. In addition, there were some wording changes under various global categories to more closely approximate observable behavior. It is anticipated that the scale modifications described would increase, rather than decrease, the reliability of the behavior rating scale. Each of the intensity levels (retained from the original scale) has an assigned score value, i.e., a score of 1 is assigned to the intensity level



"much less than other children." The highest possible score to be obtained on this scale is 48 points. Eligibility for participation in this study required that a minimum of 32 points be obtained on the rating scales completed by both the referring teacher and a parent.

### General Procedures

Subjects were brought to the laboratory area at regularly scheduled times by college students. The subjects participated in 35 minute sessions daily from Monday to Friday of each week. On occasion, subjects were absent from regularly scheduled sessions because of illness or for personal reasons which extended the length of time they participated in the study. One subject was absent for 9 consecutive days due to a tonsillectomy.

During sessions in the laboratory area, subjects were seated in a reclining chair in the inner room. A headband containing EMG surface electrodes was placed on the subject's forehead, positioned so that the three EMG surface electrodes were located 1 inch apart horizontally across the forehead and approximately 1 inch above the eyes and the bridge of the nose. Three EEG surface electrodes were also placed on the subject; a ground electrode was placed on the forehead above the right eye, adjacent to the EMG electrode on the side closest to the hairline; one of the active EEG electrodes was placed on the scalp approximately

1 inch above the subject's left ear; and the second active EEG electrode was placed on the scalp in the occipital area of the head. A temperature thermister was taped to the outside of the smallest finger of the subject's left hand; this was done to avoid the entanglement of wires or wires crossing the subject's body.

Throughout each session of the study, subjects were monitored by the experimenter or assistant through the one-way window. This was done to ensure the well-being of the subjects and to determine that the apparatus remained in place while the physiological data were being recorded.

Each subject was observed on the nine behaviors of interest (see Appendix E) by trained observers in their regular classrooms at least twice weekly on non-consecutive days at the same time each day. Home observations were conducted after school at least twice weekly at the same time for each observation day. Home observations were increased to three or more per week for those subjects who were participating in the study after the school year ended because school observations were no longer feasible. This was only required for two subjects. The trained observers did not interact with the subjects during the observations and remained in the homes or classrooms only for the 25 minute observational periods.

### Familiarization Session

Each subject was brought to the laboratory setting for one session before the first baseline session for the purpose of acquainting the subject with the setting and the apparatus. This session was conducted to minimize any fears or concerns the subject might have had about the experimental situation or the apparatus. At this session, the experimenter introduced and modeled the use of the headband containing the EMG surface electrodes, the EEG electrodes, and the thermister. Following the experimenter demonstration, the apparatus was attached to the subject. The experimenter then told the subject, "Rest quietly. I will be back in a while." The experimenter then went to the outer room of the laboratory, closing the door between the two rooms, turned the light switch located on a wall of the outer room to a pre-marked position (which placed both the inner and outer rooms in semi-darkness), and monitored the subject through the one-way window for the rest of the session. This session was 35 minutes in length. The experimenter then re-entered the inner room and removed the apparatus from the subject. The subject was then taken into the outer room and shown a file drawer containing small toys and other objects (i.e., crayons, combs, rulers) which were tagged with various numbers indicating the number of sessions of participation they would cost. The subject was told that he could

take one of the toys or objects given the number 1, or could accumulate a point for each time he attended a session and exchange points earned for toys or objects desired that were valued at a higher number. A point chart was shown to the subject that would be used in future sessions to record point earnings.

### Baseline

Baseline conditions were the same for all subjects in both experiments. Five minutes were allowed at the beginning of each session for the experimenter or assistant to attach the apparatus to the subject. The experimenter or assistant then told the subject, "Rest quietly. I will be back in a while." The adult then went into the outer room of the laboratory area, turned the light switch to the pre-marked position, and remained outside of the inner room until the end of the session. The experimenter or assistant then monitored the subject through the one-way window for the rest of the session. At the end of the session, the experimenter or assistant then returned to the inner room to remove the apparatus from the subject.

Each subject was required to participate in a minimum number of baseline sessions and also required to meet a stability criterion before the treatment condition was introduced. Subject assignment to the minimum number of baseline sessions follows:

	<u>Subject</u>	<u>Minimum number of baseline sessions</u>
<u>Experiment I</u>	1	4
	2	8
	3	12
<u>Experiment II</u>	4	4
	5	8
	6	12

The stability criterion used was as follows: The mean frontalis EMG may not vary more than one standard deviation below the mean of the three preceding sessions. All subjects met the stability criterion on the last session of their assigned minimum baseline sessions. Frontalis EMG was selected for the stability criterion because the relaxation training provided in these experiments involved muscular relaxation, and also because frontalis EMG has been reported to be indicative of relaxation of other muscles as well (Stoyva & Budzynski, 1975).

#### Experiment I--Taped Relaxation Training

Each relaxation training session was of 35 minutes duration. Sessions included a 5 minute preparation time for the apparatus to be attached to the subject, a 5 minute baseline period, a 15 minute taped relaxation training period, and a 10 minute post tape period. Relaxation training was

provided on a cassette tape. The script for this tape was an abbreviated form of the relaxation procedure used by Jacobson (1938, 1962) with some modifications. The same tape was used throughout all relaxation training sessions. A copy of the relaxation training script is included in Appendix G.

At the beginning of each relaxation training session, the experimenter or assistant attached the apparatus to the child. During the first relaxation training session for each subject, the experimenter remained in the inner room of the laboratory area with the subject after turning the light switch in the outer room to the pre-marked position and turning on the cassette tape recorder. The experimenter provided the subject with physical guidance as he followed taped instructions. The experimenter then left the room at the conclusion of the tape, instructing the subject as follows: "Rest quietly. I will be back in a while." After the final 10 minutes of the session the experimenter returned to the inner room and removed the apparatus from the subject.

In subsequent relaxation training sessions, the experimenter or assistant attached the apparatus to the subject, and then told the subject, "Rest quietly. I will be back in a while." The experimenter or assistant then left the inner room, turned the light switch to the pre-marked position, and remained in the outer room of the laboratory area for the

5 minute baseline period. The experimenter or assistant then returned to the inner room and told the subject, "I am going to turn on the tape recorder. Listen to the tape and follow the instructions. When the tape is finished, rest quietly. I will be back in a while." The experimenter or assistant then turned on the tape recorder, went into the outer room closing the door between the two rooms, and monitored the subject through the one-way window while the subject participated in the relaxation training and during the last 10 minutes of the session. The adult then returned to the inner room and removed the apparatus from the subject.

Each subject received a minimum of eight taped relaxation training sessions, but the relaxation training sessions were continued until the following stability criterion was met: the mean frontalis EMG level will be stable within plus or minus one-half microvolt for three consecutive sessions.

#### Experiment II--Backwards Tape Presentation

This experiment was conducted to determine whether any taped intervention would result in a reduction of physiological tension; in essence, Experiment II served as a control for Experiment I. Experiment II was conducted concurrently with Experiment I. Conditions for subjects assigned to Experiment II were the same as for subjects in that experiment with the following exceptions:

1. Subjects listened to a backwards presentation of the relaxation training tape used in Experiment I.
2. The first session following baseline was the same as all subsequent sessions (i.e., no experimenter present during tape).

### Observer Training and Reliability

Observers of physiological data were required to attain a 90% or above criterion level (computed on the basis of the physiological reliability formula which is described below) on practice sessions with the experimenter for each physiological variable to be monitored, for three consecutive 30 minute practice periods before they were allowed to record physiological data for subjects. Classroom and home behavioral observers were trained by a video-tape procedure, and were required to attain a 90% criterion level of performance for three consecutive practice periods prior to collecting classroom and home behavioral data for subjects.

Reliability for frontalis EMG, EEG alpha and theta activity, and finger skin temperatures was calculated by dividing the number of agreements by the total number of agreements and disagreements and multiplying by 100. Physiological data recorders were considered to be in agreement when the frontalis EMG readings were within plus or minus .5 microvolts, EEG alpha and theta activity readings were within plus or minus .5%, and finger skin temperatures were



within plus or minus .5 degrees. These small ranges were necessitated by rapid meter fluctuations and the different angles from which the two data recorders had to observe due to the size of the outer room area. Data for reliability computations were obtained by having two trained observers record data on each of the physiological dependent variables for the initial 5 minute session baseline period and the final 10 minute session time periods on approximately 25% of the sessions for such subject randomly throughout the study. Interobserver reliability was computed for classroom and home observational data according to the following formula: the total number of marked agreements in all intervals observed was divided by the total number of marked disagreements plus the total number of marked agreements multiplied by 100; no unmarked behaviors or empty intervals were included in the computations. Reliability data was collected on approximately 25% of the observations randomly throughout the study.

#### Data Analysis

A single subject analysis was used in that all data, physiological and observational, were graphed or tabulated for visual inspection for concomitancy of the dependent variables.

The physiological data for the first 5 minute and the last 10 minute time periods were summarized from individual

data sheets on a computer. The computer printouts were then attached to the individual data sheets and the summary information was recorded on the data sheets and on a master data sheet maintained for each subject. Session means and baseline and treatment medians were then graphed for ~~the~~ frontalis EMG, EEG alpha and theta activity, and finger skin temperature. Tables were compiled for the range of session means for frontalis EMG.

Data for classroom and home behavior observations were summarized on each data sheet following observation sessions. After the study was concluded, the data were compiled and mean percent of home and classroom observation intervals were graphed, and mean percent of occurrence of behavior and numerical rankings were compiled for tables.

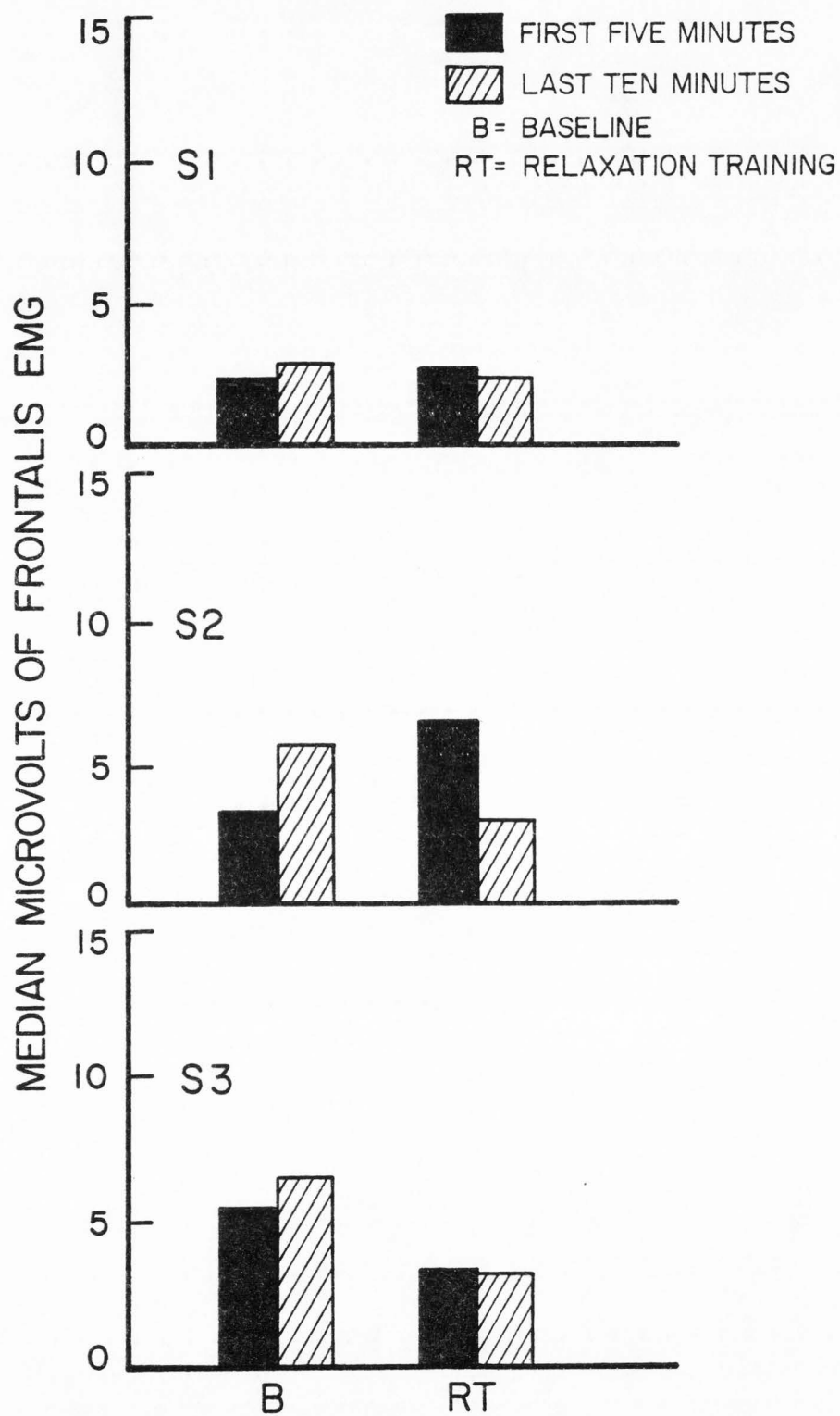
## RESULTS

### Experiment I: Taped Relaxation Training

#### EMG Frontalis Muscle Activity

In Figure 1 median EMG frontalis muscle activity for Subjects 1, 2, and 3 is shown for the first 5 minute and the last 10 minute time periods for all baseline and relaxation training sessions combined. During baseline sessions these three subjects (S1, S2, and S3) exhibited median increases for frontalis EMG, ranging from 17.7% to 66.1%, with a mean of the three medians of 37%, from the initial 5 minute time periods to the final 10 minute periods. An opposite effect was seen during the relaxation training sessions since Ss 1, 2, and 3 showed median decreases, ranging from 4.5% to 54.5%, with a mean/median of 25.6% from the initial 5 minute time periods to the last 10 minute time periods. S1 showed a slight median increase for frontalis EMG from baseline sessions to the relaxation training sessions during the initial 5 minute time periods, and a slight median decrease during the final 10 minute periods, but, overall, these changes were quite small. Subject 2 exhibited higher median frontalis EMG during the first 5 minute periods of relaxation training sessions as compared to the baseline sessions (increasing by 94%), but during the last 10 minute

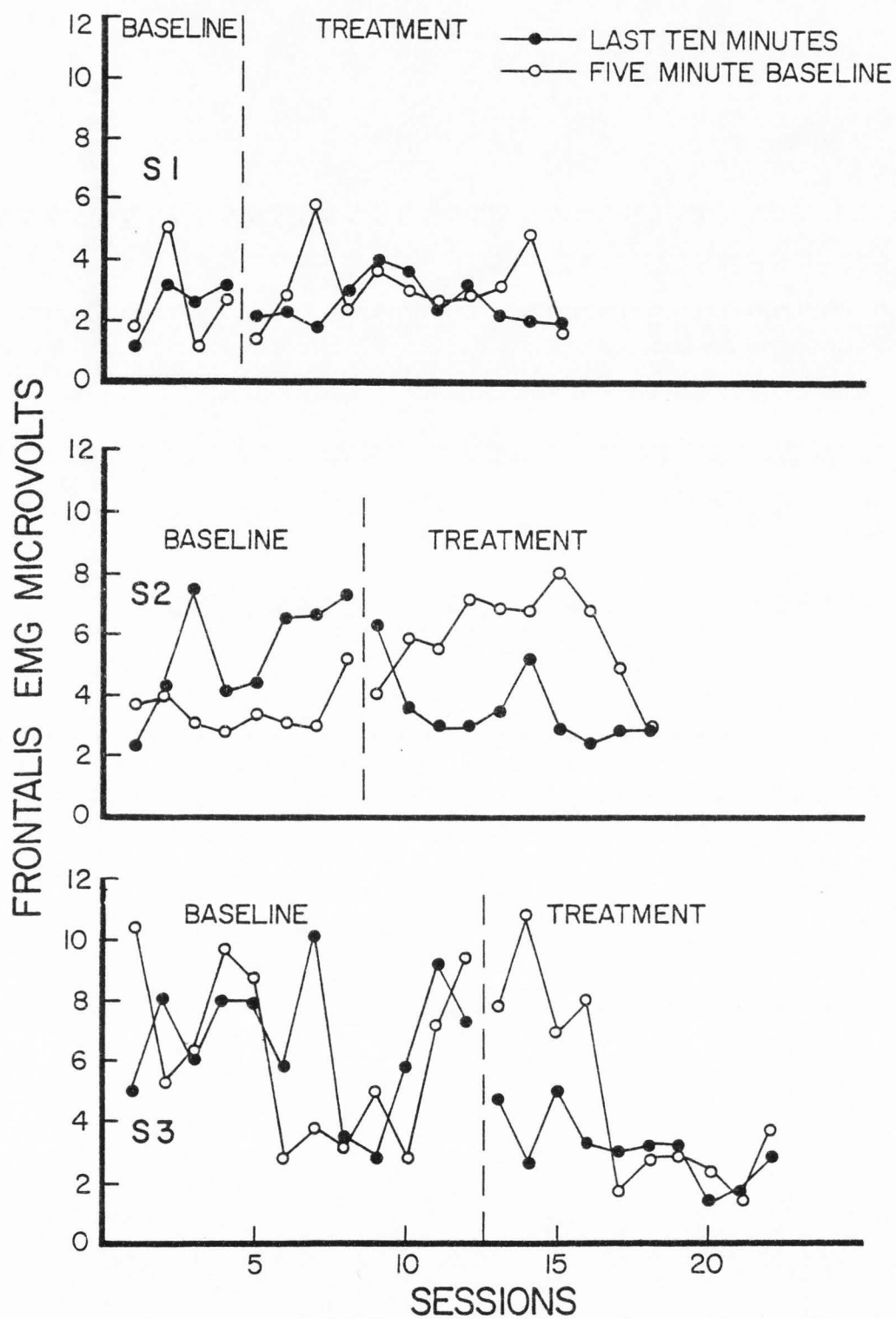
Figure 1. Median Microvolts of Frontalis EMG for  
Subjects 1, 2, and 3.



time periods, S2's median frontalis EMG was lower for the relaxation training sessions than for the baseline sessions (decreasing by 46.8%). S3 showed a median decrease of 40.7% during the first 5 minute time periods from baseline to relaxation training sessions, and a median decrease of 52% during the final 10 minute time periods across the same conditions.

Figure 2 shows session means for EMG frontalis muscle activity for Subjects 1, 2, and 3 for the baseline and the relaxation training condition for the first 5 minute and the last 10 minute time periods. S1 demonstrated greater variability on mean session EMG frontalis muscle activity during the first 5 minute time periods than shown for the last 10 minute time periods under both baseline and the relaxation training condition. Overall, lower session means for frontalis EMG were found for S1 than for the other two subjects. S3, who participated in eight baseline sessions, demonstrated greater variability for mean session EMG frontalis for the last 10 minute time periods than for the first 5 minute time periods during the baseline; a tendency toward stability of frontalis EMG session means can be seen for S3 under the relaxation training condition for the last 10 minute time periods as compared to the first 5 minute time periods. In fact, the EMG level and stability during the last 10 minutes during relaxation training is very similar to that exhibited during the first 5 minute periods of

Figure 2. Session Mean Frontalis EMG Microvolts for Subjects 1, 2, and 3.





baseline sessions. High variability on session means for EMG frontalis muscle activity was demonstrated by S3, who participated in 12 baseline sessions, throughout the baseline for both the first 5 minute and the last 10 minute time periods. During the final 10 minute time periods of the relaxation training condition, S3 showed less variability of mean session frontalis EMG. Subjects 1, 2, and 3 exhibited distinctly different EMG frontalis muscle activity profiles.

The range of session means for frontalis EMG is shown in Table 1 for Subjects 1, 2, and 3 for the initial 5 minute and the final 10 minute time periods for the baseline and the relaxation training condition. S1 evidenced the narrowest range of mean EMG frontalis muscle activity of the three subjects for the final 10 minute time periods. The widest range of mean EMG frontalis muscle activity was exhibited by S3 for the first 5 minute time periods during the baseline and the relaxation training condition, and for the last 10 minute time periods of the baseline sessions; this subject exhibited a considerably narrower range of session means for the last 10 minute time periods for the relaxation training condition. S2 showed an increased range of session means from the first 5 minute time periods to the last 10 minute time periods for the baseline; whereas, the range of mean session frontalis EMG decreased from the first 5 minute time

Table 1  
Range of Session Mean Microvolts of EMG Frontalis Muscle Activity  
for Subjects 1, 2, and 3

	S1		S2		S3	
	F5M	L10M	F5M	L10M	F5M	L10M
Baseline	1.6-5.1	1.3-3.3	2.8-5.2	2.4-7.5	2.7-10.5	2.8-10.1
Relaxation Training	1.4-5.9	1.8-4.0	2.6-8.0	2.3-6.3	1.8-10.9	1.3- 5.1

F5M = First 5 minute time periods  
L10M = Last 10 minute time periods

periods to the last 10 minute time periods for the relaxation training condition.

Reliability of EMG frontalis muscle activity for Subjects 1, 2, and 3 ranged from 83.3% to 93.3%, with a mean of 89.9%.

#### EEG Alpha (8-12 Hertz) Activity

Median EEG alpha activity is shown for Subjects 1, 2, and 3 in Figure 3 for the first 5 minute and the last 10 minute time periods for baseline and relaxation training sessions. EEG alpha median decreases of 6.6% and 5.4% were found from the first 5 minute to the last 10 minute time periods during baseline for Subjects 1 and 3, respectively, while no change was seen for S2. From the first 5 minute to the last 10 minute time periods during relaxation training sessions, median decreases of 3.4% and 9.8% were exhibited by Subjects 2 and 3, respectively, but S1 showed a median increase of 7.1% across the same time periods. Median EEG alpha during baseline and relaxation training sessions for Subjects 1, 2, and 3 ranged from 49.9% to 67.65%, with a mean of the three medians of 51.9%. These three subjects exhibited comparable levels of EEG alpha activity throughout the experiment.

Figure 4 shows session mean percentages of EEG alpha produced by Subjects 1, 2, and 3 during all sessions in which they participated for the first 5 minute and the last 10 minute time periods. Subjects 1 and 2 evidenced fairly

Figure 3. Median Percent of EEG Alpha (8-12 Hertz)  
Activity for Subjects 1, 2, and 3.

B = BASELINE  
RT = RELAXATION TRAINING

■ FIRST FIVE MINUTES

▨ LAST TEN MINUTES

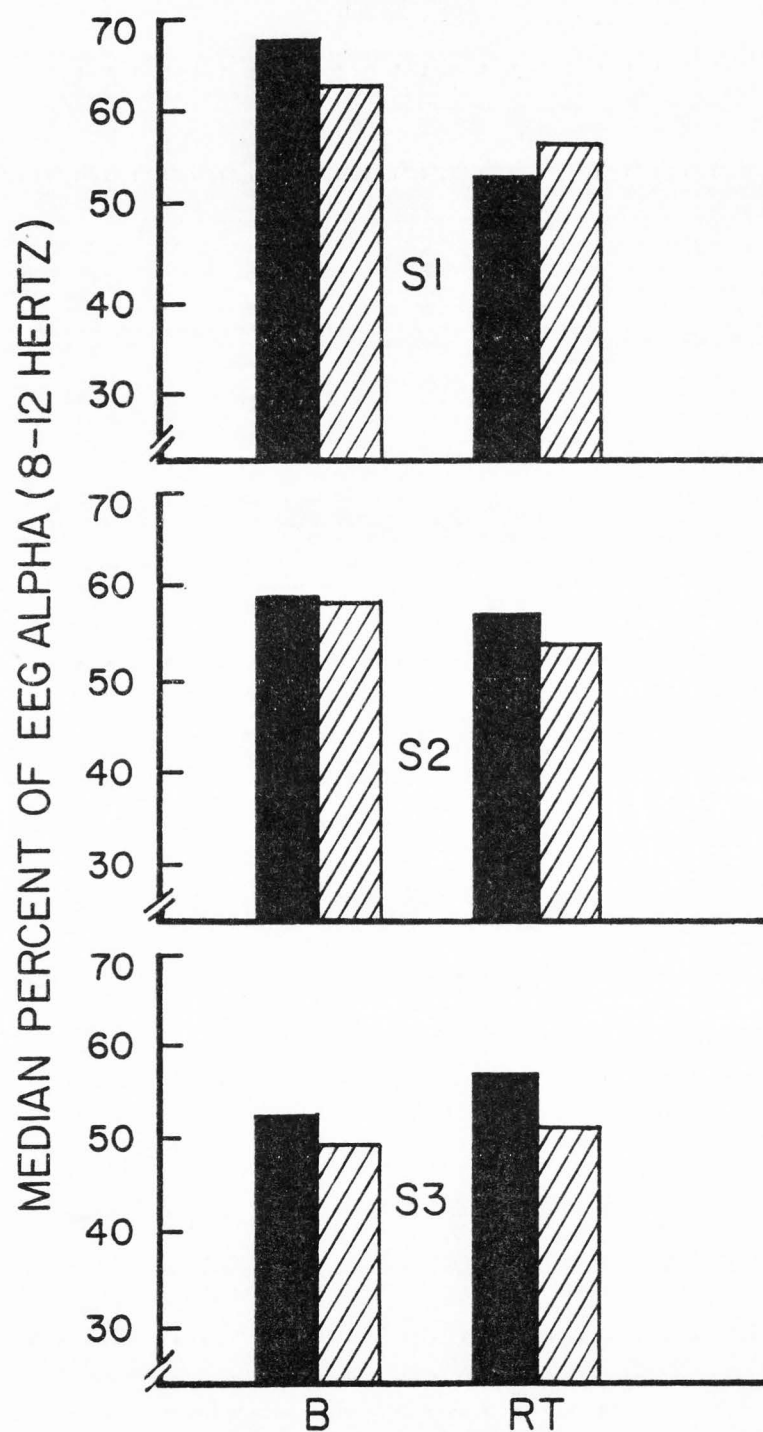
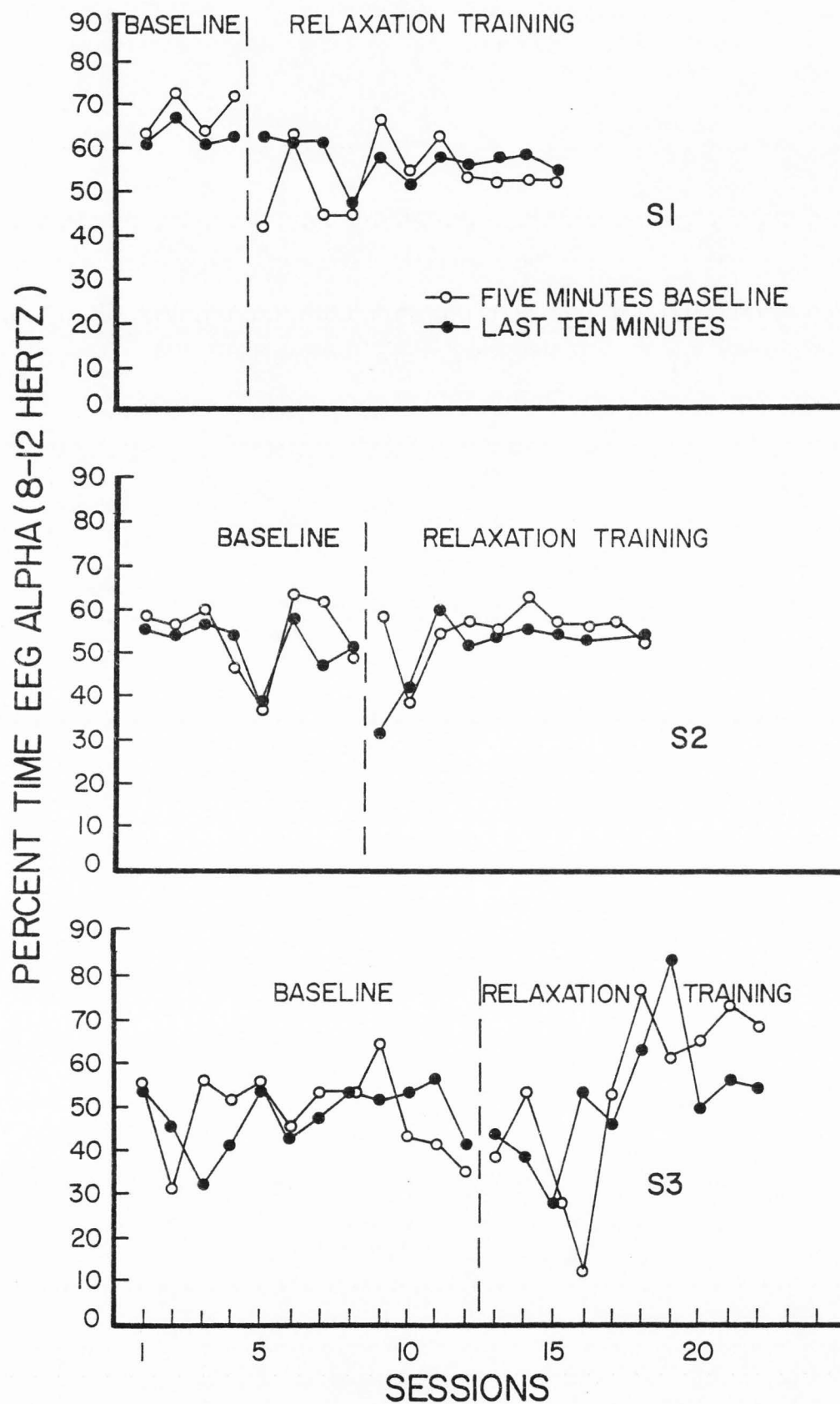


Figure 4. Session Mean Percent of EEG Alpha (8-12 Hertz)  
Activity for Subjects 1, 2, and 3.



stable EEG alpha activity during baseline and relaxation for both the first 5 minute and the last 10 minute time periods, particularly for the relaxation training sessions, as compared to S3.

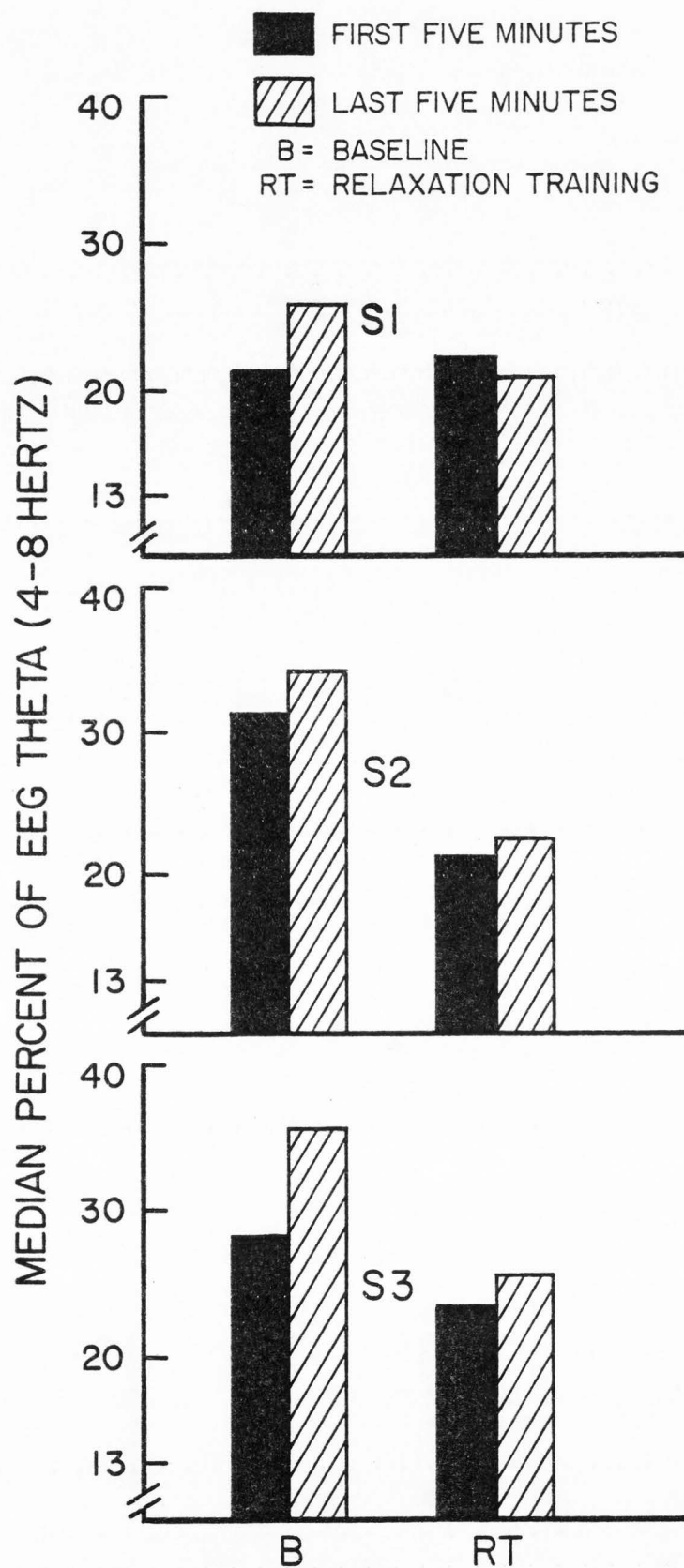
Reliability of EEG alpha activity ranged from 96.6% to 100%, with a mean of 99.4%.

#### EEG Theta (4-8 Hertz) Activity

Median EEG theta activity for Subjects 1, 2, and 3 is shown in Figure 5 for baseline and relaxation training sessions for the initial 5 minute and the final 10 minute time periods. Each of these three subjects (S1, S3, and S3) showed EEG theta median increases during the baseline from the initial 5 minute to the final 10 minute time periods, ranging from 10.4% to 26.5%, with a mean of the three medians of 20.2%. Median increase of 5.3% and 14.3% were also exhibited by Subjects 2 and 3, respectively, for EEG theta activity from the initial 5 minute to the final 10 minute time periods during relaxation training sessions in contrast to S1, who exhibited a median decrease of 5.6%. Overall, median increases shown for EEG theta activity were greater than for EEG alpha activity for these subjects. In addition, median EEG theta activity for Subjects 1, 2, and 3 were comparable for the first 5 minute and the last 10 minute time periods from baseline to the relaxation training sessions.



Figure 5. Median Percent of EEG Theta (4-8 Hertz)  
Activity for Subjects 1, 2, and 3.



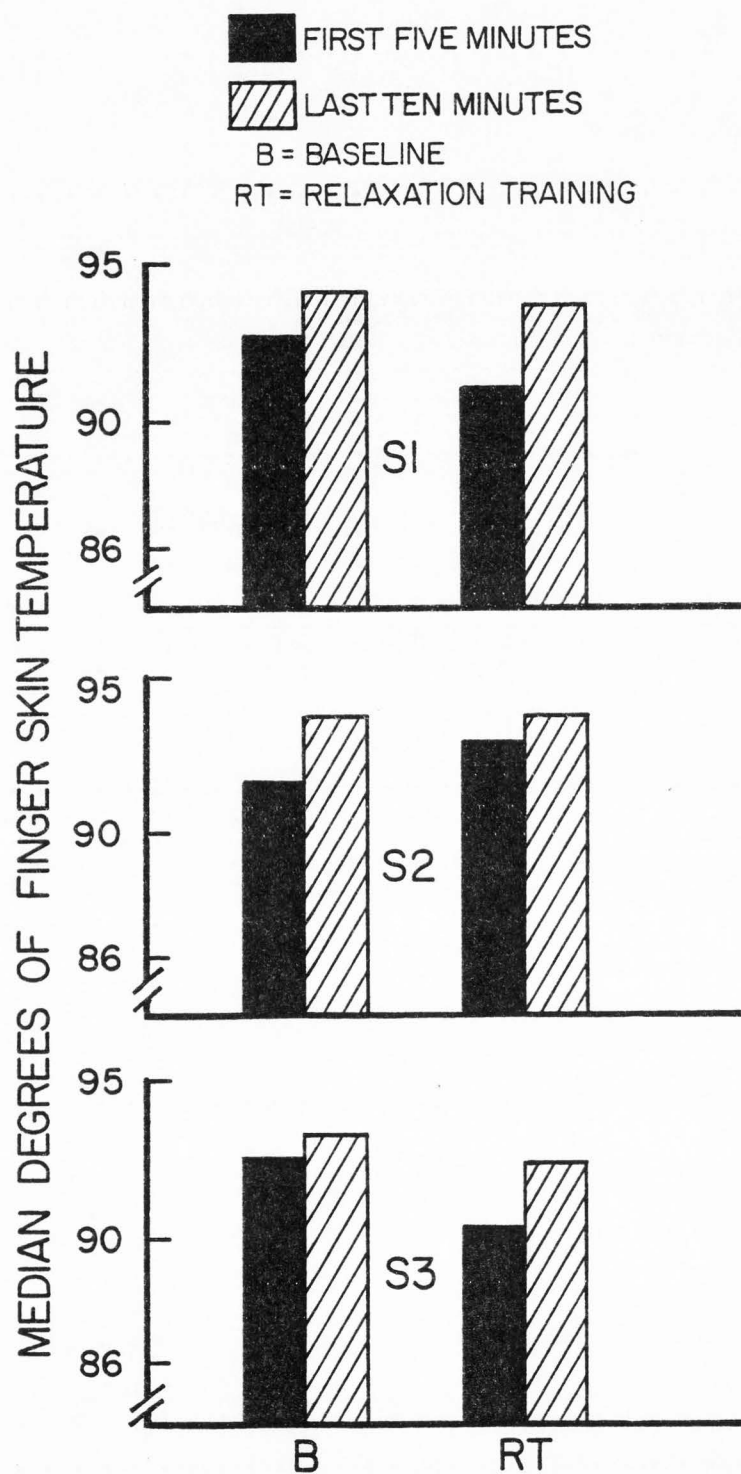
Although the data are not graphed, a review of the session mean EEG theta for Subjects 1, 2, and 3 showed that overall, EEG theta session means were lower for Subjects 1, 2, and 3 than EEG alpha session means during baseline and relaxation training sessions for both the first 5 minute to the last 10 minute time periods. S1 exhibited less variability than Subjects 2 and 3 during both baseline and relaxation training sessions for the first 5 minute and the last 10 minute time periods. In general, session means for Subjects 1, 2, and 3 were related to EEG alpha session means in an inverse relationship (i.e., high session mean EEG alpha, low session mean EEG theta).

Reliability of EEG theta activity ranged from 96.6% to 100% with a mean of 98.3%.

#### Finger Skin Temperature

Median finger skin temperature for Subjects 1, 2, and 3 is shown in Figure 6 for baseline and relaxation sessions combined for the first 5 minute and the last 10 minute time periods. During baseline sessions, Subjects 1, 2, and 3 all showed median increases from the first 5 minute to the last 10 minute time periods, however, these increases were of small magnitude, ranging from .06% to 2.1%, with a mean of the three medians of 1.25%. Median increases for finger skin temperature were also seen for Subjects 1, 2, and 3 from the first 5 minute time periods to the last 10 minute

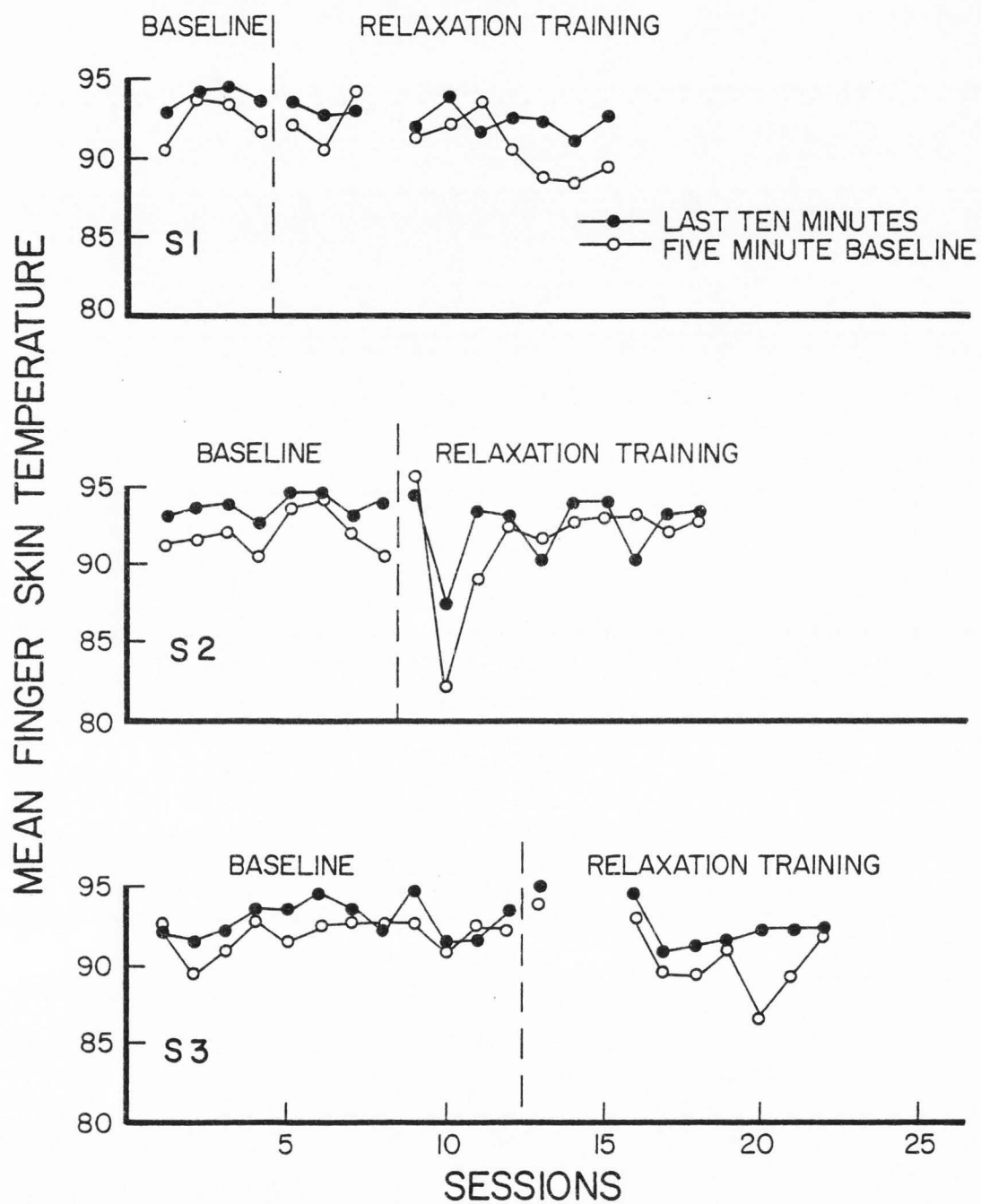
Figure 6. Median Degrees of Finger Skin Temperature for Subjects 1, 2, and 3.



time periods during the relaxation training sessions, ranging from .09% to 2.3%, with a mean of the three medians of 1.4%. Skin temperature median changes were minimal for all three subjects (S1, S2, and S3). Overall, median finger skin temperatures ranged from 90.4° to 94.15° for these subjects.

Finger skin temperature session means for Subjects 1, 2, and 3 are shown in Figure 7 for the first 5 minute and the last 10 minute time periods of the baseline and the relaxation training sessions. Session means for finger skin temperature were stable for S1 throughout the study with slightly more variability for the first 5 minute time periods. S1 also showed a trend toward lower session means for finger skin temperature for the first 5 minute time periods during the last four sessions of relaxation training compared to previous sessions; this trend was not found for the last 10 minute time periods. Both Subjects 2 and 3 demonstrated stability in session means for finger skin temperature for the first 5 minute and the last 10 minute time periods of baseline sessions. Under the relaxation training condition, however, Subjects 2 and 3 evidenced greater mean session variability than during baseline, and they also showed greater mean session variability between the first 5 minute and the last 10 minute time periods. Because of instrument failure, data for finger skin temperature

Figure 7. Session Means for Finger Skin Temperature for Subjects 1, 2, and 3.





were not recorded for two sessions for S3 during the relaxation training condition.

Reliability on finger skin temperature for Subjects 1, 2, and 3 ranged from 96.6% to 100% with a mean of 98.9%.

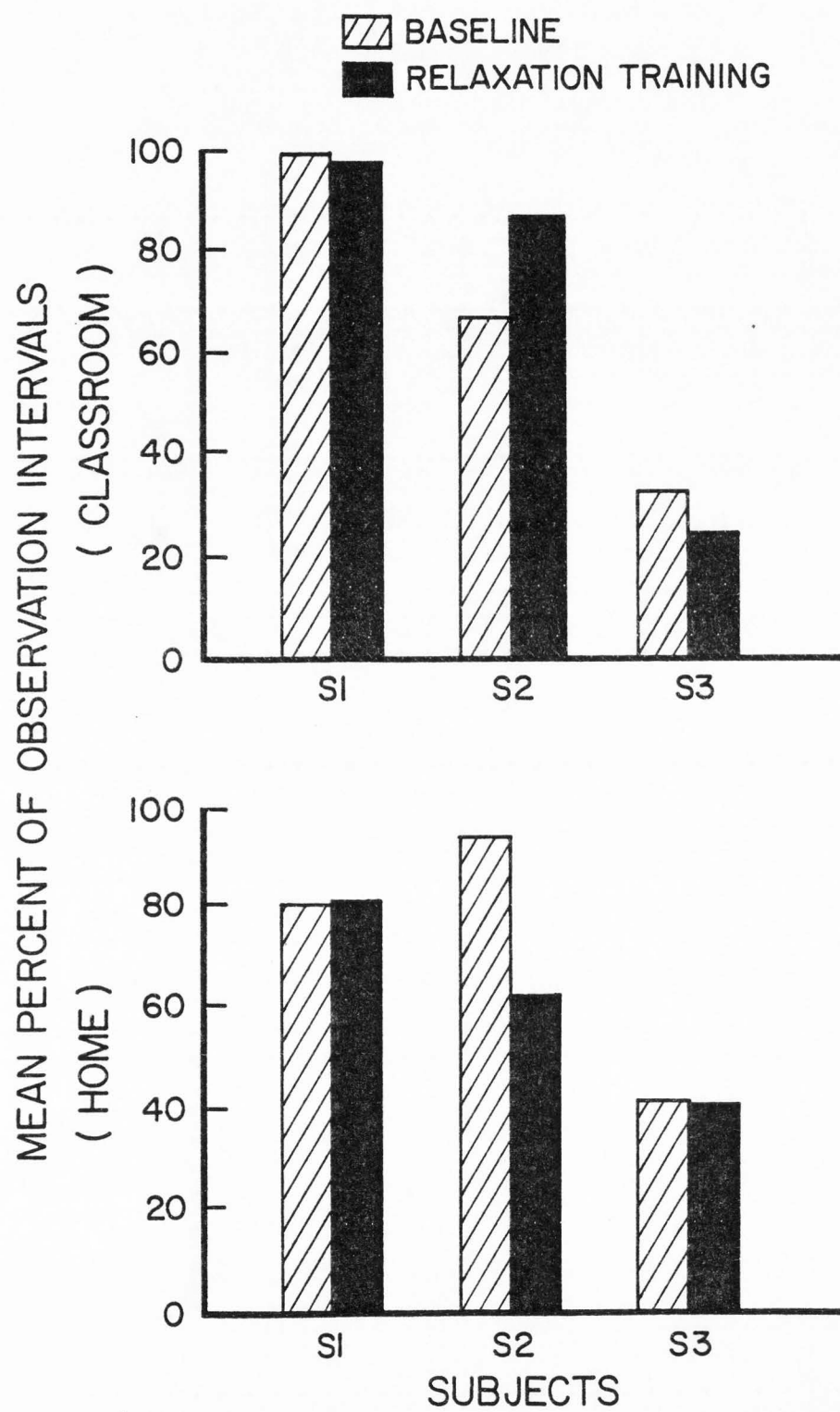
#### Number of Relaxation Training Sessions

Subjects 1, 2, and 3 participated in taped relaxation training for additional sessions beyond the arbitrary eight sessions in order to meet the stability criterion for termination of relaxation training. Both Subjects 2 and 3 participated in 10 relaxation training sessions, and S1 participated in 11 relaxation training sessions.

#### Classroom and Home Observations

Figure 8 shows the mean percent of intervals during which one or more of the nine behaviors specified for observation (see Appendix E) were exhibited in the classroom and home settings by Subjects 1, 2, and 3 under baseline and the relaxation training condition. Changes in mean percent of intervals of observed behaviors from baseline to the relaxation training condition were negligible for S1 in both the classroom and the home settings. Decreases in mean percent of intervals of observed behaviors were shown by S2 in the home setting and by S3 in the classroom setting from the baseline to the relaxation training condition; whereas, S2 exhibited an increase in mean percent of intervals of observed behavior in the classroom setting and S3 showed

Figure 8. Mean Percent of Classroom and Home Observation Intervals for Subjects 1, 2, and 3.



relatively no change in the home setting. In summary, no consistent decreases were found for Subjects 1, 2, or 3 with respect to mean percent of intervals of observed behavior in either the home or classroom settings as a result of relaxation training.

The mean percent occurrence of each of the nine specified behaviors (see Appendix E) observed in the classroom and home settings for Subjects 1, 2, and 3 are shown in Tables 2 and 3, respectively. It can be seen that each subject displayed idiosyncratic behavior patterns. Analysis of the session by session observational data revealed no systematic differences among the nine behaviors observed. In addition, the variability between baseline and treatment was similar for all three subjects. The number of observations with each subject varied, depending on the number of baseline and treatment sessions. In some cases, there were very few observations during baseline and a higher number of observations during treatment; in other cases, there were more observations during baseline than during treatment.

Reliability of classroom observations ranged from 85% to 96%, with a mean of 91%. Reliability of home observations ranged from 91% to 96%, with a mean of 93.7%.

Table 2

Mean Percent Occurrence of Classroom Observed Behaviors for Subjects 1, 2, and 3

	S1		S2		S3	
	B	RT	B	RT	B	RT
Out of Seat (OS)	1.9	1.9	2.6	11.5	6.7	7.2
Seat Movement (SM)	51.9	52.5	5.9	14.0	0	0
Body Position (PB)	20.4	26.7	14.0	7.8	14.4	71.7
Body Movement (BR)	5.9	5.0	5.5	1.1	4.1	7.8
Hand/Arm Movement (HM)	88.5	83.7	50.0	37.4	1.9	2.8
Leg/Foot Movement (FM)	47.0	47.5	25.5	59.6	2.0	0
Vocalization (AV)	11.1	2.1	4.8	6.7	11.9	2.2
Person Contact (CP)	0	1.5	0	0	.6	.6
Object Contact (NO)	2.7	4.2	.03	1.8	.9	0

B = Baseline

R = Relaxation Training

Table 3

Mean Percent Occurrence of Home Observed Behaviors for Subjects 1, 2, and 3

	S1		S2		S3	
	B	RT	B	RT	B	RT
Out of Seat (OS)	.07	4.4	11.5	.93	6.5	8.6
Seat Movement (SM)	0	.02	7.0	2.0	.74	.28
Body Position (PB)	9.3	16.7	9.6	.55	3.1	9.4
Body Movement (BR)	3.0	1.7	.37	.37	13.0	8.6
Hand/Arm Movement (HM)	78.9	68.4	8.1	21.7	17.0	18.3
Leg/Foot Movement (FM)	19.6	24.8	44.0	56.3	6.3	6.7
Vocalization (AV)	29.6	21.6	17.8	57.6	13.1	10.5
Person Contact (CP)	0	.06	.37	.19	0	.28
Object Contact (NO)	1.1	.1	1.9	1.1	1.3	1.9

B = Baseline

RT = Relaxation Training

## Experiment II: Backwards Tape Presentation

### EMG Frontalis Muscle Activity

Median EMG frontalis muscle activity for Subjects 4, 5, and 6 is shown in Figure 9 for the first 5 minute and the last 10 minute time periods of baseline, backwards tape presentation, and relaxation training sessions. From the initial 5 minute time periods to the final 10 minute time periods during baseline sessions, S4 showed a negligible median increase of 1.5%, S5 showed a negligible median decrease of 1%, and S6 showed a median increase of 27%. From the first 5 minute time periods to the last 10 minute time periods during backwards tape presentation sessions, both Subjects 5 and 6 demonstrated median increase of small magnitude, 3.6% and 1.1%, respectively; a median decrease was shown by S4 of 9.6% for the same time periods. During relaxation training sessions, from the initial 5 minute time periods to the final 10 minute time periods, Subjects 4 and 6 showed median decreases of 2.7% and 3.9%, respectively, and S5 showed a median increase of 1.8%. Neither the backwards tape presentations or relaxation training appeared to produce a meaningful reduction of frontalis EMG for these subjects. Median changes from baseline to the backwards tape presentation during both the first 5 minute and the last 10 minute time periods increased for S4, and decreased for Subjects 5 and 6; similar median changes were also seen from baseline to the relaxation training condition.

Figure 9. Median Microvolts for Frontalis EMG for  
Subjects 4, 5, and 6.



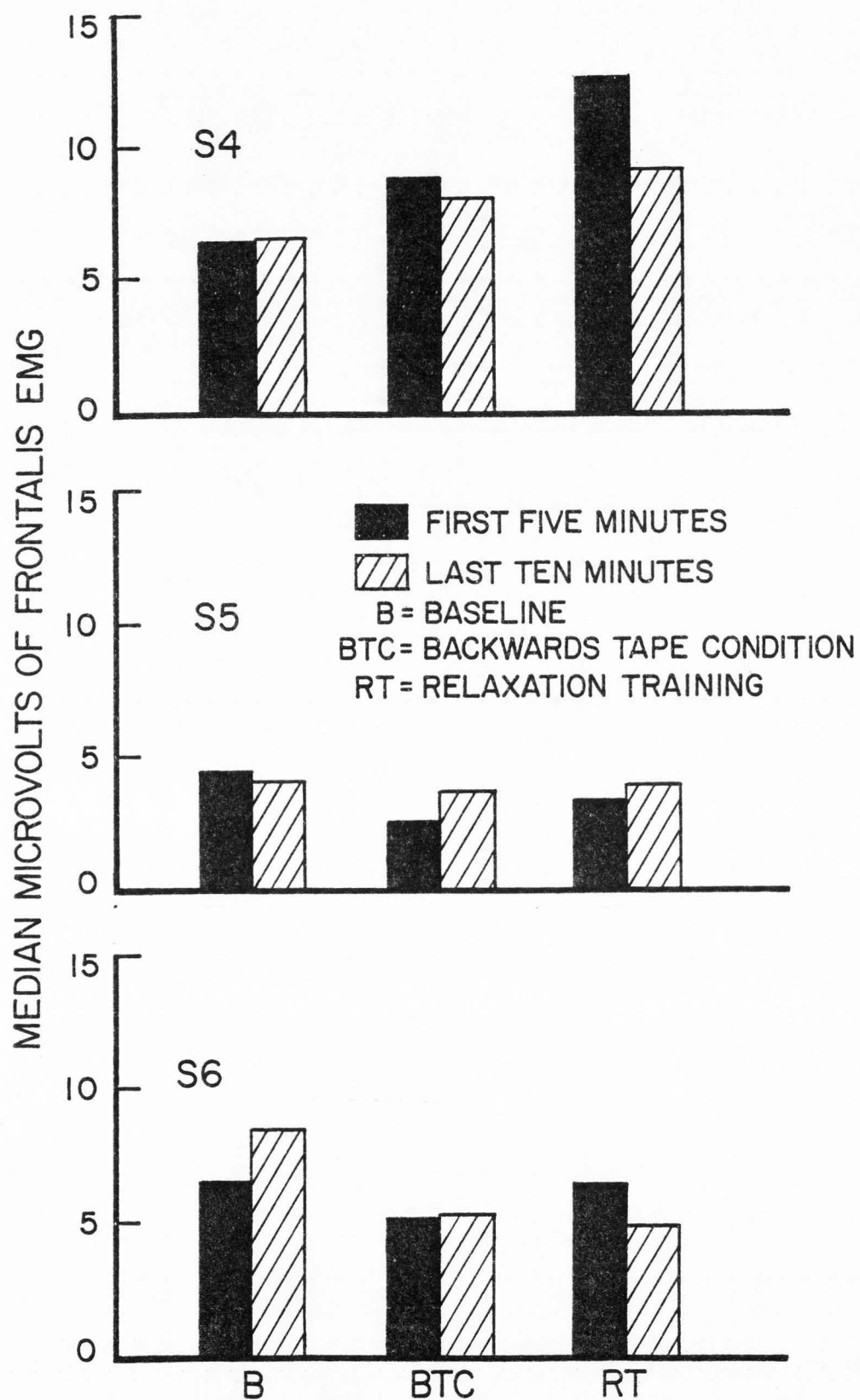
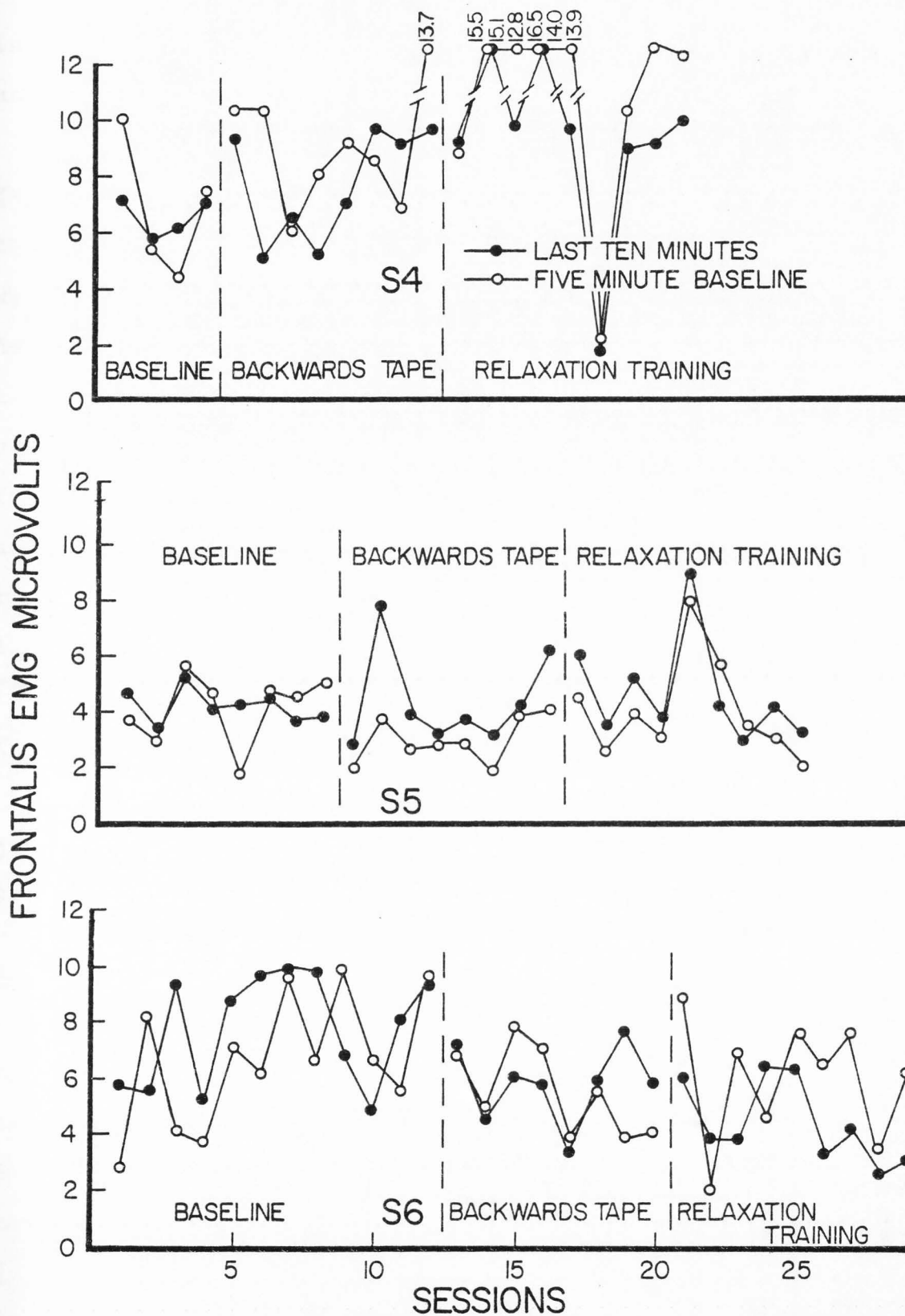


Figure 10 shows the session means for EMG frontalis muscle activity for Subjects 4, 5, and 6 for the baseline, the backwards tape sessions, and the relaxation training sessions for the first 5 minute and the last 10 minute time periods. The highest frontalis EMG session means were exhibited by S4 of all three subjects (S4, S5, and S6), and the highest intrasubject session means for frontalis EMG were exhibited by this subject for the first 5 minute time periods during relaxation training sessions. Subject 4 also exhibited more mean session variability for frontalis EMG than either S5 or S6 across all conditions for both time periods; whereas, S5 showed the least mean session variability for frontalis EMG than the other two subjects for both the initial 5 minute and the last 10 minute time periods across all conditions. It can be seen, however, that S5 showed a tendency toward increased mean session stability for frontalis EMG for the last 10 minute time periods in contrast to the first 5 minute time periods, particularly throughout the baseline sessions. Although S6 exhibited greater mean session variability for frontalis EMG than S5 across all conditions for both time periods, the variability was greater for the first 5 minute time periods than for the last 10 minute time periods. Each of these three subjects (S4, S5, and S6) exhibited distinctly different frontalis EMG profiles, and Subjects 4 and 6 showed the most

Figure 10. Session Mean Frontalis EMG Microvolts for Subjects 4, 5, and 6.



intrasubject variability among the three subjects (S4, S5, and S6) during the initial 5 minute time periods.

Table 4 shows the range of session means for frontalis EMG for Subjects 4, 5, and 6 for the initial 5 minute and the final 10 minute time periods for the baseline, the backwards tape sessions, and the relaxation training sessions. As seen, S4 showed the widest range of session means of the three subjects (S4, S5, and S6) for frontalis EMG. Intra-subject ranges of session means for frontalis EMG were also found to be more variable for S4 than for Subjects 5 or 6 across conditions and for both time periods; the narrowest range exhibited by this subject was 1.0 microvolts for the last 10 minute time periods during baseline sessions, and the widest range shown for S4 was 14.4 microvolts for the first 5 minutes of the relaxation training sessions.

Reliability of EMG frontalis muscle activity for Subjects 4, 5, and 6 ranged from 86.6% to 93.3%, with a mean of 90.2%.

#### EEG Alpha (8-12 Hertz) Activity

Median EEG alpha activity for Subjects 4, 5, and 6 is shown in Figure 11 for all baseline, backwards tape presentation, and relaxation sessions combined for the initial 5 minute and the final 10 minute time periods. All three subjects (S4, S5, and S6) showed EEG alpha activity median increases from the first 5 minute time periods to the last 10 minute time periods during baseline sessions, ranging

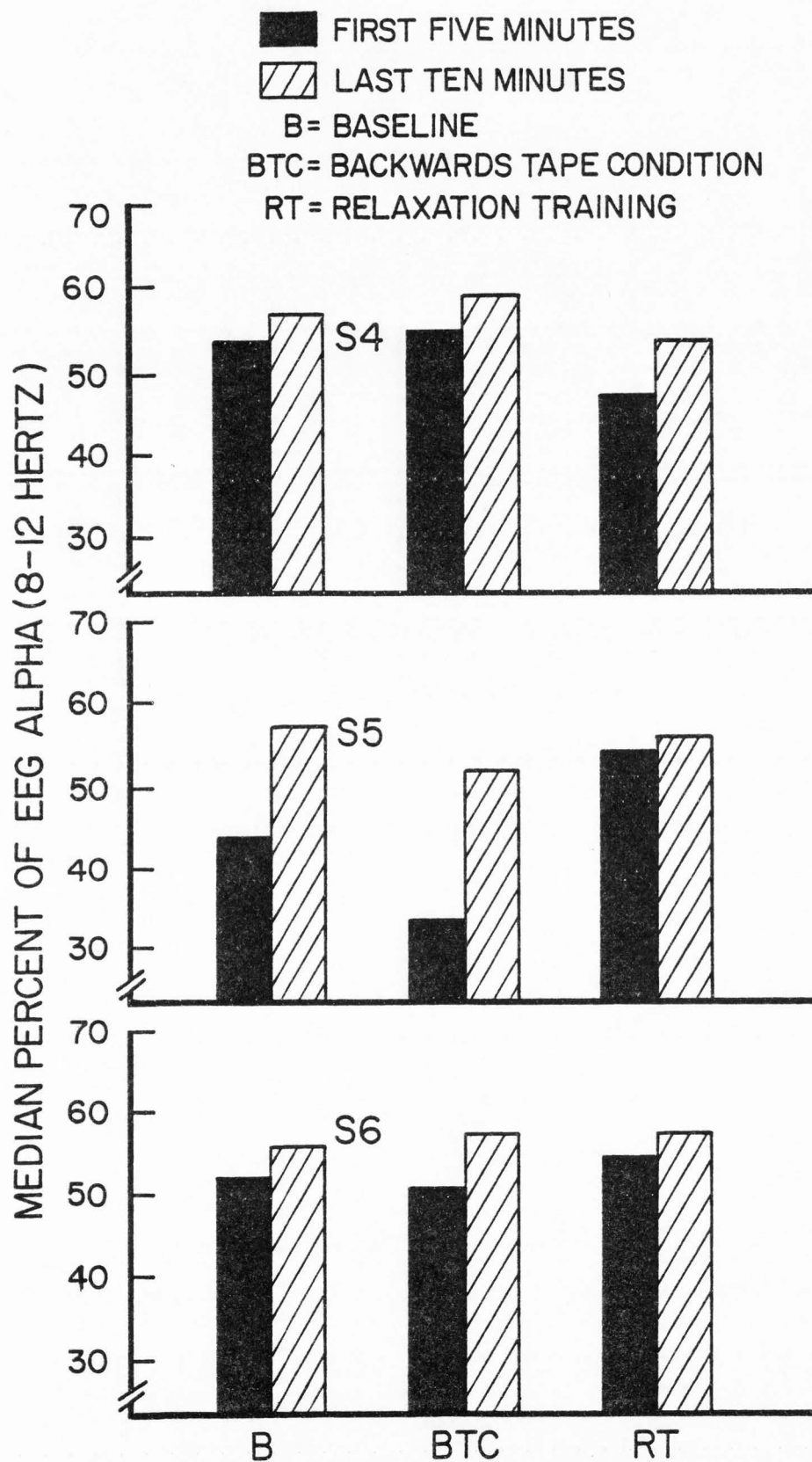
Table 4

Range of Session Mean Microvolts of EMG Frontalis Muscle Activity  
for Subjects 4, 5, and 6

	S4		S5		S6	
	F5M	L10M	F5M	L10M	F5M	L10M
Baseline	4.5-10.3	5.7- 6.7	1.9-5.6	3.4-5.2	2.8-9.8	4.9-9.9
Backwards Tape Condition	6.0-13.7	4.7- 9.6	1.9-4.0	2.9-7.9	3.7-7.9	3.5-7.7
Relaxation Training	2.1-16.5	1.7-15.1	2.1-7.9	2.5-8.8	2.0-8.9	2.6-6.5

F5M = First 5 minute time periods  
L10M = Last 10 minute time periods

Figure 11. Median Percent of EEG Alpha (8-12 Hertz)  
Activity for Subjects 4, 5, and 6.

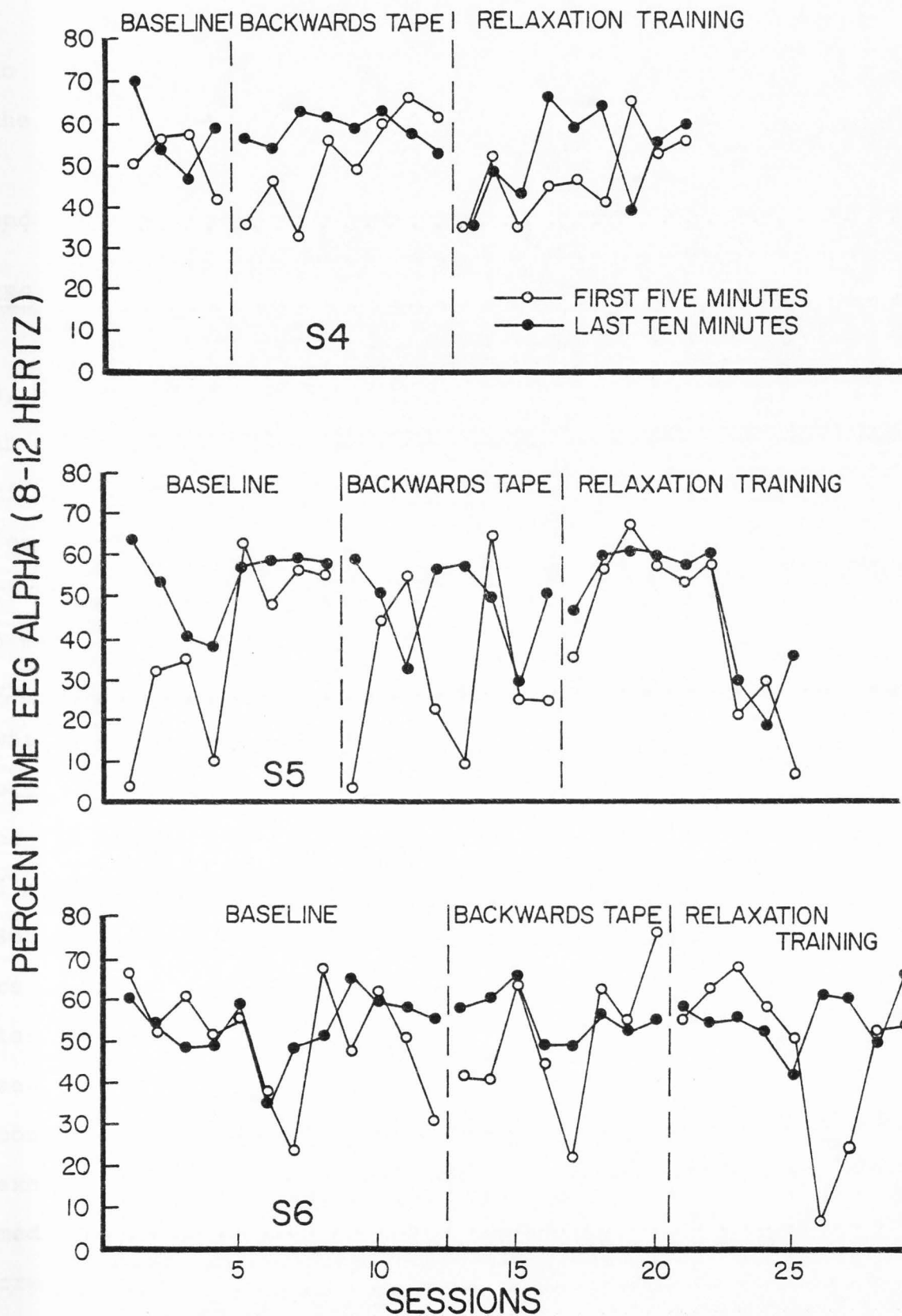




from 4.3% to 27.5%, with a mean of the three medians of 12.9%. Median increases were also seen during the backwards tape presentation sessions, ranging from 9.4% to 52.4%, with a mean of the three medians of 24.8%. During the relaxation training sessions, these subjects (S4, S5, and S6) again showed median increases from the initial 5 minute time periods to the final 10 minute time periods, ranging from 2.8% to 19.1%, with a mean of the three medians of 8.4%. EEG alpha activity medians for Subjects 4, 5, and 6 ranged from 33.5% to 59.3%, with a mean of 52.5%; medians were comparable for these three subjects.

Session mean EEG alpha activity is shown in Figure 12 for Subjects 4, 5, and 6 for the baseline, the backwards tape sessions, and the relaxation training sessions for the initial 5 minute time periods and the final 10 minute time periods. Session mean variability was shown by all three subjects (S4, S5, and S6) for the first 5 minute time periods across all conditions. S4 exhibited session mean stability for EEG alpha activity for the last 10 minute time periods of the backwards tape presentation sessions; otherwise, this subject showed session mean variability under the baseline and the relaxation training condition. Both Subjects 5 and 6 exhibited session mean variability for the last 10 minute time periods across all conditions. It can be seen that session mean variability for EEG alpha activity appears

Figure 12. Session Mean Percent of EEG Alpha (8-12 Hertz)  
Activity for Subjects 4, 5, and 6.



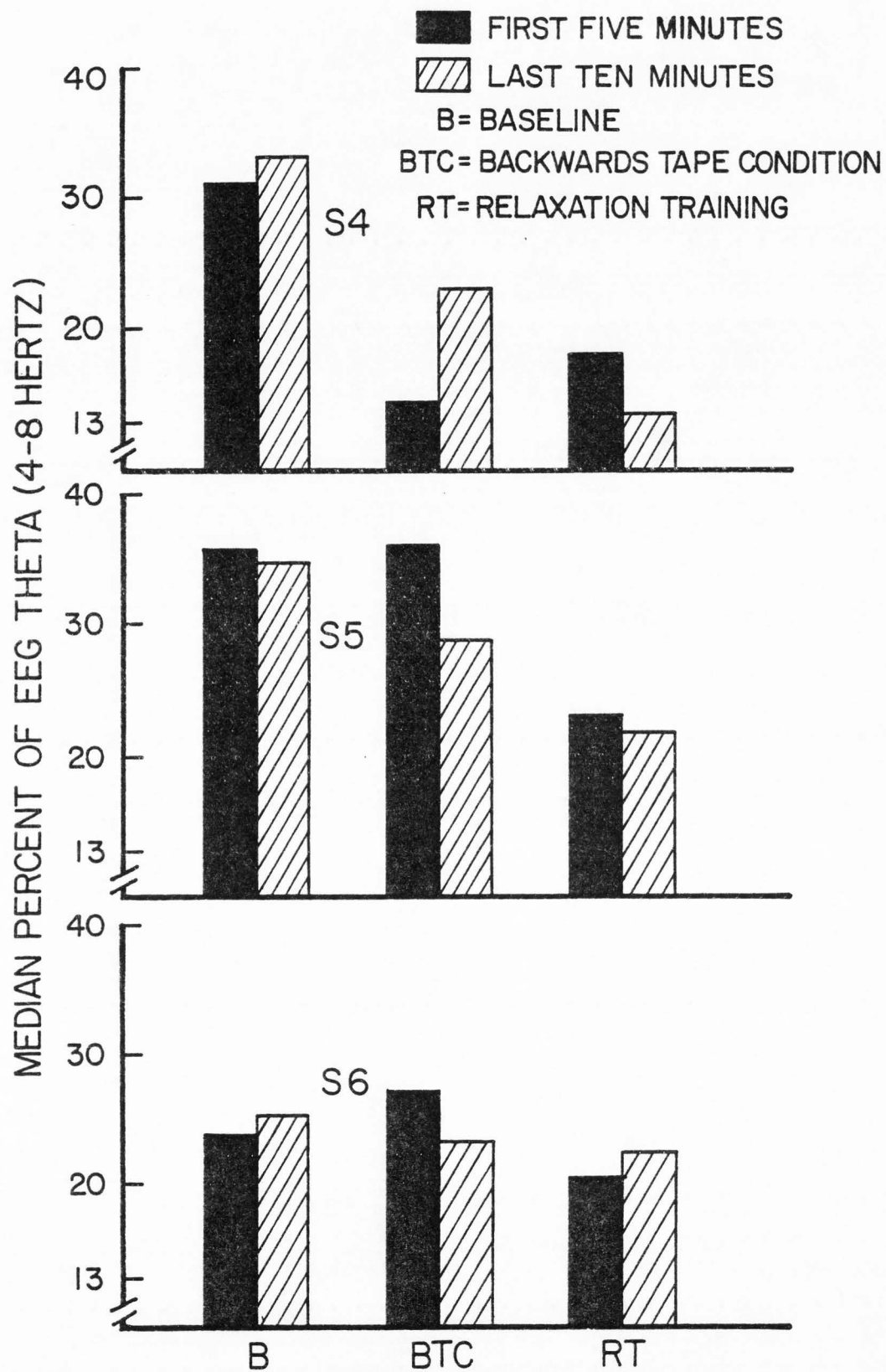
to be greater for the first 5 minute time periods than for the last 10 minute time periods.

Reliability of EEG alpha activity for Subjects 4, 5, and 6 ranged from 43.3% to 100%, with a mean of 95.8%.

#### EEG Theta (4-8 Hertz) Activity

Figure 13 shows median EEG theta activity for Subjects 4, 5, and 6 for all baseline, backwards tape presentation, and relaxation training sessions for the initial 5 minute time periods and the last 10 minute time periods. Median increases of 4% and 4.2% were shown by Subjects 4 and 6, respectively, during baseline sessions from the initial 5 minute time periods to the final 10 minute time periods, while S5 showed a 1.1% median decrease. During the backwards tape presentation sessions, S4 showed a median increase of 67.8%, while Subjects 5 and 6 showed median decreases of 18.9% and 14.5%, respectively, from the initial 5 minute time periods to the final 10 minute time periods. Subjects 4 and 5 showed median decreases of 25.6% and 7.7%, respectively, from the initial 5 minute time periods to the last 10 minute time periods during the relaxation training sessions; S6 showed a median increase of 9.8% for the same condition. Each of these three subjects (S4, S5, and S6) exhibited idiosyncratic EEG theta profiles; no systematic median changes were seen. S4 showed median EEG theta decreases from baseline to the backwards tape presentation

Figure 13. Median Percent of EEG Theta (4-8 Hertz)  
Activity for Subjects 4, 5, and 6.



sessions and from baseline to the relaxation training sessions for both the first 5 minute and the last 10 minute time periods. S5 showed similar EEG medians from baseline to the backwards tape presentation sessions for the first 5 minute time periods, but a median decrease for the last 10 minute time periods. This subject showed median decreases from baseline to the relaxation training sessions for both time periods. Minimal median EEG theta changes were shown by S6 across conditions and for both time periods.

Although the data are not graphed, a review of the session mean EEG theta for Subjects 4, 5, and 6 showed that variability was highest for Subjects 4 and 5, and that S6 showed the most stability of the three subjects. S5 showed the highest intrasubject variability during the first 5 minute time periods of the backwards tape condition, while S4 showed the highest intrasubject variability during the last 10 minute time periods during relaxation training sessions. Of the three subjects (S4, S5, and S6), S6 showed the least variable total means for each condition (baseline, backwards tape, relaxation training) for both the first 5 minutes and the last 10 minutes of sessions under these conditions; S4 showed the most variability for total means for the same time periods. EEG theta session means for Subjects 4, 5, and 6 were related to EEG alpha session means in an inverse relationship; typically high mean

session EEG alpha seen with low mean session EEG theta. Overall EEG theta session means were lower than found for EEG alpha.

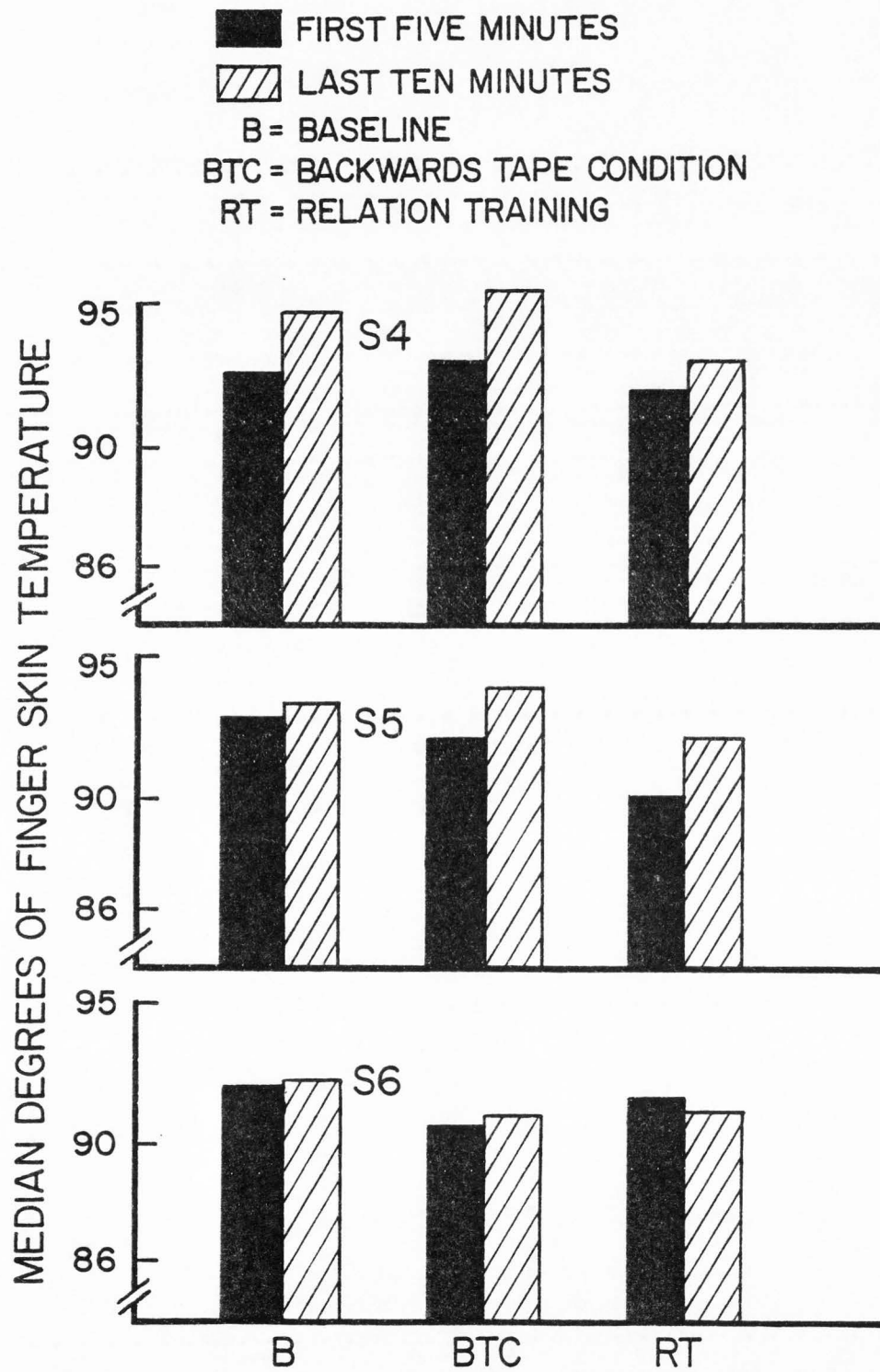
Reliability of EEG theta activity ranged from 90% to 100%, with a mean of 97.9%.

#### Finger Skin Temperature

The median finger skin temperatures for Subjects 4, 5, and 6 are shown in Figure 14 for all baseline, backwards tape presentation, and relaxation training sessions for the initial 5 minute and the last 10 minute time periods. Both Subjects 4 and 5 showed negligible median increases in finger skin temperature for each of the conditions from the first 5 minute to the last 10 minute time periods; median increases ranged from .49% to 2.6%, with a mean of the three medians of 1.7%. S6 showed no median change from the first 5 minute to the last 10 minute time periods during baseline sessions; this subject showed a 1% median increase during the backwards tape presentations from the first 5 minute to the last 10 minute time periods; and a negligible median decrease of .04% was seen for S6 during the relaxation training sessions across the time periods. Median finger skin temperatures for S4 remained relatively unchanged across conditions for the first 5 minute and the last 10 minute time periods. S5 showed slightly decreased finger skin temperature medians from baseline to the backwards tape

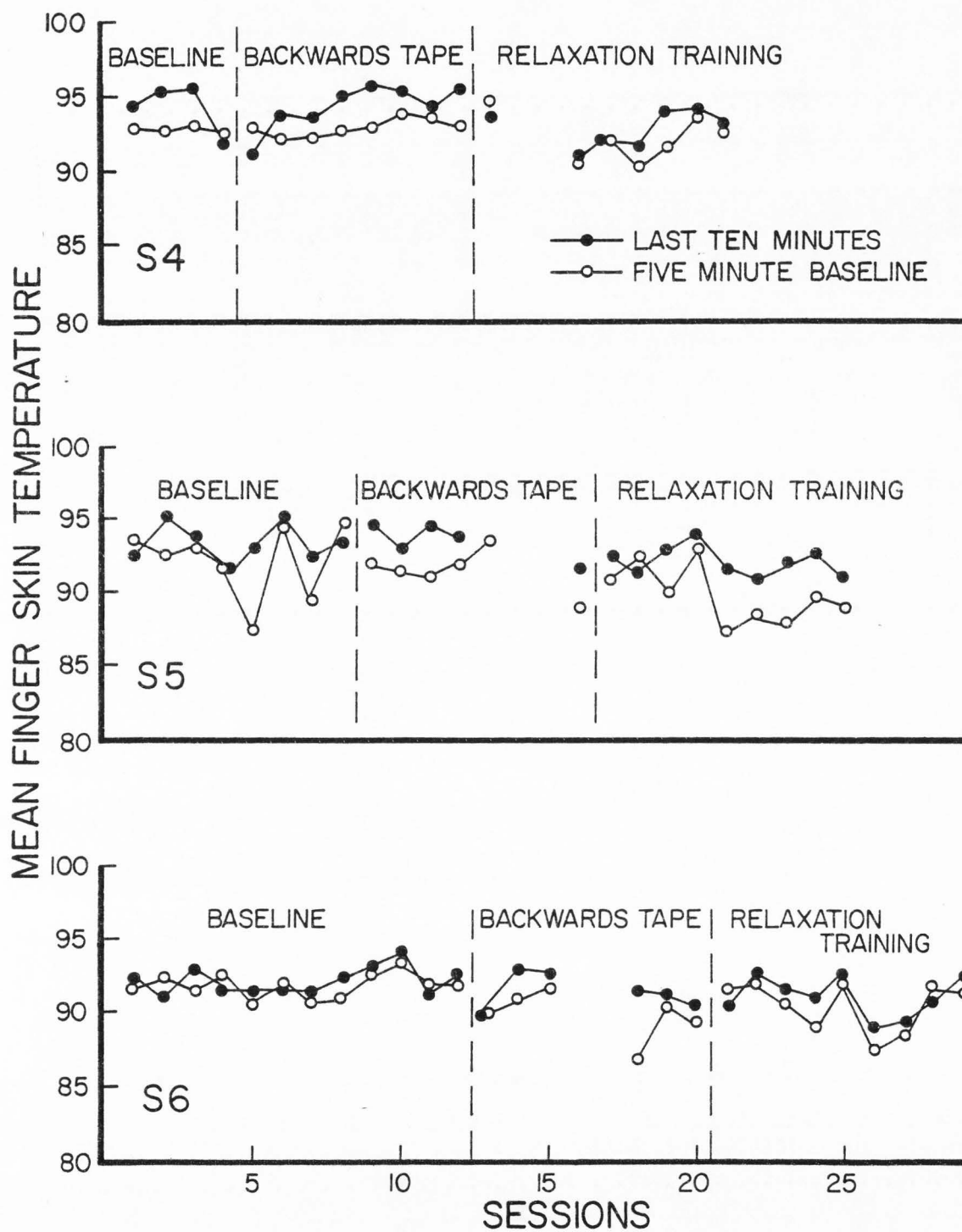


Figure 14. Median Degrees of Finger Skin Temperature for  
Subjects 4, 5, and 6.



presentation sessions and from baseline to the relaxation training sessions for the first 5 minute time periods; however, for the last 10 minute time periods, from baseline to the backwards tape presentation sessions, S5 showed almost no change; a median decrease of small magnitude was exhibited by S5 from baseline to the relaxation training sessions for the last 10 minute time periods. S6 showed relatively no change in median finger temperature across conditions for both time periods. Overall, median finger skin temperatures ranged from 89.9° to 95.6° for Subjects 4, 5, and 6.

For Subjects 4, 5, and 6, finger skin temperature session means are shown in Figure 15 for baseline, backwards tape presentation, and relaxation training sessions for the initial 5 minute and the final 10 minute time periods. Because of instrument failure, finger skin temperatures were not recorded for two sessions for S4 during the relaxation training condition and for two sessions for both S5 and S6 during the backwards tape condition. Session mean finger skin temperature tended to be lower for these three subjects (S4, S5, and S6) for the first 5 minute time periods than for the last 10 minute time periods across all conditions; this finding appears to be more evident for Subjects 4 and 5 than for S6. Of the three subjects (S4, S5, and S6), S5 exhibited the most variability in session mean finger skin



temperature, particularly during the baseline and the relaxation training condition.

Reliability for finger skin temperature ranged from 96.6% to 100%, with a mean of 94%.

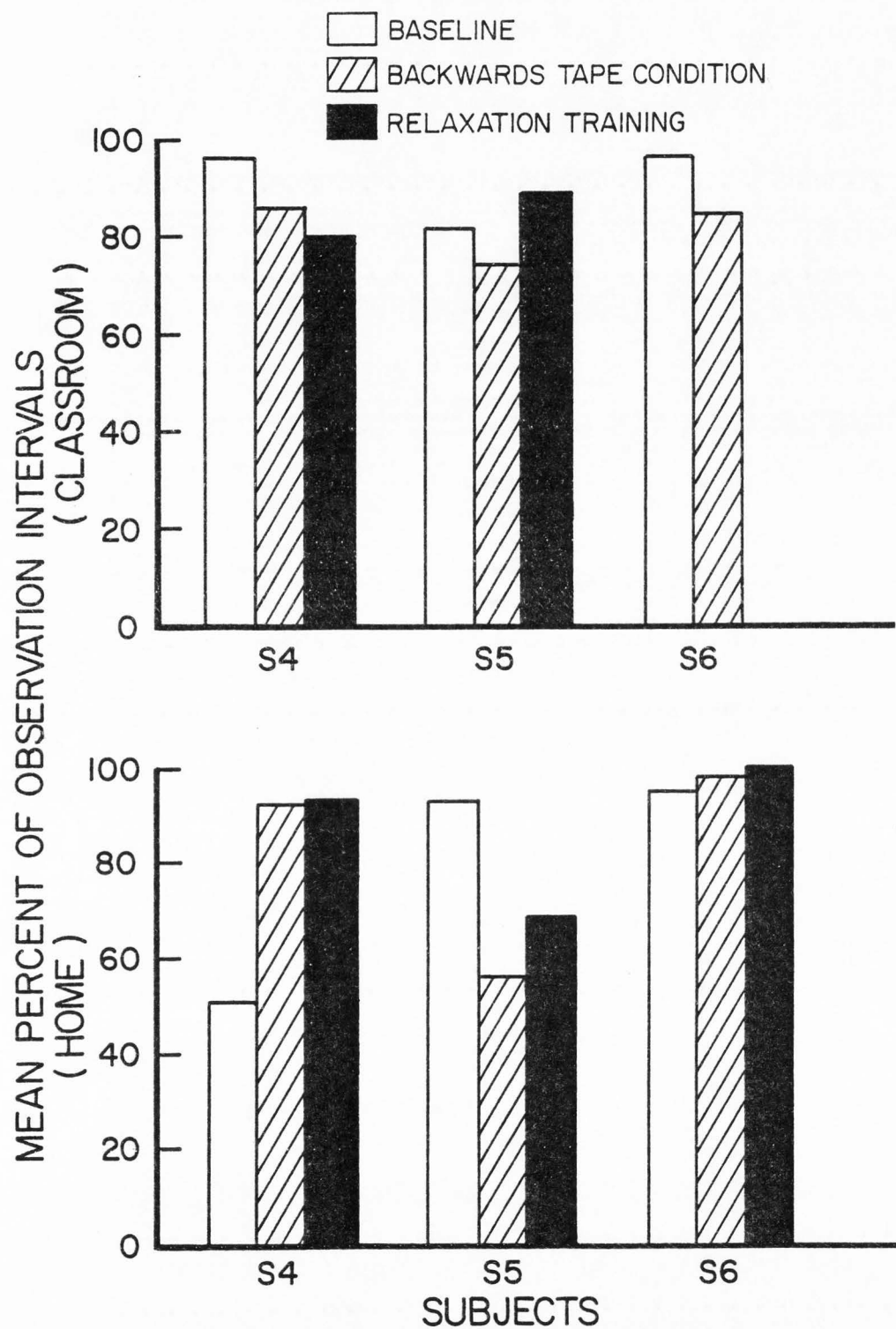
#### Number of Relaxation Training Sessions

Subjects 4, 5, and 6 participated in nine relaxation training sessions following baseline and backwards tape presentation sessions. The relaxation training condition was terminated when each subject met the stability criterion for termination.

#### Classroom and Home Observations

Figure 16 shows the mean percent of intervals during which one or more of the behaviors specified for observation were exhibited in the classroom and the home settings by Subjects 4, 5, and 6 while these three subjects were participating in baseline, backwards tape presentation, and relaxation training sessions. S6 was not observed in the classroom setting during the relaxation training condition because the school year had ended. In the classroom setting, Subjects 4, 5, and 6 exhibited high mean percentages for observed behavior during the baseline sessions. All three subjects (S4, S5, and S6) showed mean decreases for observed behaviors from the baseline to the backwards tape condition, as did S4 from the backwards tape condition to

Figure 16. Mean Percent of Classroom and Home Observation Intervals for Subjects 4, 5, and 6.



the relaxation training condition, and from the baseline to the relaxation training condition. Conversely, S5 showed a mean percentage increase for observed behaviors from the backwards tape condition to the relaxation training condition, and from the baseline to the relaxation training condition.

In the home setting, S4 exhibited a mean increase for observed behaviors from the baseline to the backwards tape condition and from the baseline to the relaxation training condition. Relatively no change was shown by S4 for the backwards tape condition to the relaxation training condition for mean percent of intervals of observed behavior. A mean decrease was exhibited by S5 from the baseline to the backwards tape condition and from the baseline to the relaxation training condition; whereas, this subject showed a mean increase for observed behaviors from the backwards tape condition to the relaxation training condition. Negligible mean increases were exhibited by S6 across conditions in the home setting. While Subjects 4, 5, and 6 were participating in backward tape sessions, all three subjects showed mean decreases in observed classroom behaviors specified; however, only S5 showed a mean decrease in the home setting as well as in the classroom setting. This finding appears to have no significance since systematic changes across settings for all three subjects (S4, S5, and S6) were not seen, and the mean decreases were not large.



Mean percent of occurrence of the nine observed behaviors (see Appendix E) for Subjects 4, 5, and 6 are shown in Table 5 for the classroom setting and in Table 6 for the home setting. Idiosyncratic behavior profiles can be seen for these three subjects (S4, S5, and S6). Analysis of the session by session observational data revealed no systematic differences among the nine behaviors observed. In addition, the variability between baseline, backwards tape presentation, and relaxation training was similar for all three subjects. The number of observations under different conditions varied for each subject because of the multiple baseline sessions; thus, in some cases there were fewer observations during baseline than during backwards tape presentation or relaxation training, while in other cases, there were more observations during baseline than under other conditions.

Reliability of classroom observations ranged from 90.2% to 96%, with a mean of 93.6% and reliability of home observations ranged from 89% to 97%, with a mean of 94.1%.

Table 5

Mean Percent Occurrence of Classroom Observed Behaviors for Subjects 4, 5, and 6

	S4			S5			S6	
	B	BTC	RT	B	BTC	RT	B	BTC
Out of Seat (OS)	12.8	5.9	0	12.8	43.9	21.1	7.3	21.1
Seat Movement (SM)	57.2	51.1	17.8	17.5	9.4	8.3	0	2.2
Body Position (PB)	55.0	42.2	21.1	11.4	10.5	32.8	9.5	14.8
Body Movement (BR)	36.7	33.0	36.7	1.7	.55	0	10.7	5.6
Hand/Arm Movement (HM)	58.9	41.1	15.5	39.7	10.0	30.0	81.0	45.6
Leg/Foot Movement (FM)	9.4	7.4	10.0	35.0	33.3	31.1	58.9	26.7
Vocalization (AV)	58.3	23.3	31.1	35.3	36.7	30.0	8.2	20.0
Person Contact (CP)	0	1.5	1.1	.28	0	1.1	0	0
Object Contact (NO)	0	.74	2.2	5.3	2.2	.55	1.3	1.9

B = Baseline  
 BTC = Backwards Tape Condition  
 RT = Relaxation Training

Table 6

Mean Percent Occurrence of Home Observed Behaviors for Subjects 4, 5, and 6

	S4			S5			S6		
	B	BTC	RT	B	BTC	RT	B	BTC	RT
Out of Seat (OS)	2.2	8.9	.55	3.6	18.9	.83	1.9	4.8	28.5
Seat Movement (SM)	2.2	54.4	.78	11.7	0	.55	4.9	9.6	11.8
Body Position (PB)	21.1	43.0	77.8	8.6	1.1	.55	8.2	8.9	26.7
Body Movement (BR)	22.8	46.0	30.0	.83	0	0	6.7	20.7	8.1
Hand/Arm Movement (HM)	20.5	40.7	8.9	48.3	35.0	26.9	72.2	97.4	81.1
Leg/Foot Movement (FM)	4.4	8.1	6.7	26.1	19.4	36.1	45.1	36.3	19.0
Vocalization (AV)	8.9	16.3	24.4	40.3	16.7	43.6	49.5	37.3	58.1
Person Contact (CP)	1.7	4.8	0	0	0	.28	7.5	0	3.3
Object Contact (NO)	0	.74	0	.28	2.2	2.8	10.2	11.5	1.9

B = Baseline  
 BTC = Backwards Tape Condition  
 RT = Relaxation Training

## DISCUSSION

### Experiment I: Taped Relaxation Training

One of the purposes of this study was to determine whether or not reduced levels of physiological tension would be demonstrated by children identified as hyperactive when presented with taped relaxation training. The results of this experiment do not indicate that relaxation training was effective in reducing physiological tension as determined by a reduction of frontalis EMG, an increase in EEG alpha and theta activity, or an increase in finger skin temperature.

The finding that systematic decreases in frontalis EMG were not seen for Subjects 1, 2, and 3 in this experiment are contradictory to findings reported by Braud (1978). According to Braud, taped relaxation training produced significant decreases in frontalis EMGs for a group of five children identified as hyperactive between 6 and 13 years of age. Braud's subjects participated in 12 relaxation training sessions, provided twice weekly for six weeks. In Braud's study, subjects listened to and followed taped relaxation instruction during 30 minute sessions; subjects first practiced relaxation exercises while reclining on an air mattress for 15 minutes, and then practiced for another

15 minutes while sitting in a straight-back chair. An adult was present to assist subjects in correctly following taped instructions throughout all training sessions. The procedures followed for relaxation training in the Braud study were quite different from those followed in this experiment. In addition to the presence of an adult to assist subjects in relaxation exercises at each session (instead of during one familiarization session), Braud's subjects received longer sessions for relaxation practice, and had opportunity to practice relaxation exercises in two body positions. Subjects in Braud's study participated in spaced sessions over a six week period, instead of consecutive sessions over a shorter period of time, even though the total number of sessions in both studies were comparable (12 versus 10 and 11). It is speculated that the procedural differences noted partially explain why subjects in Braud's study showed significant decrements in EMG and subjects in this experiment did not.

However, other differences between the two studies also exist. Comparison of results between Braud's findings and those of this experiment are inappropriate because of differences in EMG data collection and analysis, particularly since Braud's study was a group design. It was reported by Braud (1978) that monitoring of frontalis EMG consisted of six monitoring periods of approximately 15 minutes duration; one monitoring period occurred approximately two days before

training began; four monitoring periods were conducted during relaxation training, beginning after the second training session; and a final monitoring period was conducted approximately two days after the last training session. EMG data for the five subjects in the relaxation training group were combined, and reported EMG results reflected group mean differences between pre and post training monitoring periods; a 58.8% decrease was reported.

Stoyva and Budzynski (1975) have reported that adult subjects demonstrating higher baseline frontalis EMG levels than other subjects prior to receiving biofeedback training showed a higher percentage of EMG decrease as a result of training than those subjects exhibiting lower pretraining EMGs. The upper half of Stoyva and Budzynski's sample, with a combined group mean of approximately 5.2 microvolts for seven subjects, showed a 46% decline in frontalis EMG, while the lower half of their sample, with a combined mean of approximately 3.0 microvolts, only showed a decline of 13%. Since these results are reported for group data, they are not directly applicable to this experiment. However, it does appear that initial baseline frontalis EMG levels for single subjects influence the degree of reduction seen as a result of training to reduce EMG frontalis muscle activity. Kinsman and Staudenmayer (1978) also reported that initial baseline levels and baseline ranges of frontalis EMG influenced treatment effects in EMG biofeedback training.

These investigators (Kinsman & Staudenmayer, 1978) found that there was a relatively greater decrease in frontalis EMG over training for those subjects with high baseline levels than for those subjects with low baselines, and, in fact, some subjects with low baselines showed EMG increases rather than expected decreases in frontalis EMGs. Subjects 1, 2, and 3 in this experiment showed median baseline levels of frontalis EMG ranging from 2.3 to 6.5 median microvolts; thus, the magnitude of median percent decrease possible was limited because of the initial microvolt levels. In contrast, the group mean at pretraining monitoring in Braud's study was approximately 27 microvolts (estimated from the published graph), suggesting that subjects in Braud's study showed higher levels of frontalis EMG prior to training than the subjects in this experiment. Although baseline frontalis EMG levels were not as high as those found in Braud's subjects, Striefel (1977-78) found in some pilot work that taped relaxation training provided to eight school-age children identified as hyperactive resulted in decreased frontalis EMGs from an average baseline level of 7 microvolts to an average of 2.3 microvolts.

There are also published reports indicating that frontalis EMG biofeedback training with hyperactive children has resulted in decreased frontalis EMG levels (Braud, Lupin & Braud, 1975; Hampstead, 1979; Hughes, Henry, & Hughes, 1980). These studies are interesting in comparison to the present

study because they show that a reduction in frontalis EMG can be achieved by hyperactive children. Baseline frontalis EMG levels differed among the studies cited, but all investigators reported treatment effects. Hampstead (1979) reported that two groups of six children, ages 6 to 9 years, diagnosed as hyperactive, showed EMG session microvolt averages during an initial baseline period ranging from about 3.5 to 6.5 microvolts, which were reduced to a range of 2 to 4 microvolts after the first phase of EMG feedback training. Hampstead also reported a statistical treatment effect between the first and second phases of biofeedback training when the range of EMG session averages decreased further to an average of 1 to 3 microvolts. Hughes et al. (1980) provided frontalis EMG biofeedback training to three hyperactive children between 6 and 10 years of age. These investigators reported that baseline EMG levels (averaged for five sessions) for their subjects ranged from 11.70 to 16.37 microvolts, which decreased significantly as a result of training. In 1975, Braud et al. reported that a 6-1/2 year old hyperactive boy showed "dramatic" changes in a downward direction within and between frontalis EMG biofeedback training sessions; no actual EMG microvolt levels were reported in this study, so it is not possible to determine the percent change in tension reduction. Data graphically presented in the Braud et al. (1975) published report shows



that decreases exhibited by subjects in the number of tension seconds (data recorded) during initial four-minute session baseline periods were similar to the decreases in number of tension seconds shown for "after feedback," which was not discussed by the authors; thus, it appears that the results reported would be diminished if differences between initial baseline periods and after feedback periods were taken into account. In the present study, the initial 5 minute time periods in combination with the final 10 minute time periods after the relaxation tape served as a control for subject variability from session to session, and allowed an accurate assessment of treatment effects.

Extended baseline periods were found to be associated with sequentially larger decreases in percent change in median frontalis EMGs for Subjects 1, 2, and 3 due to relaxation training; as noted earlier, these three subjects participated in a comparable number of relaxation training sessions. S1, who participated in four baseline sessions showed the least percent median decrease in frontalis EMG, while Subjects 2 and 3, who participated in eight and twelve baseline sessions, respectively, showed increasingly larger decrements of percent change (see Figures 1 and 2). It may be that this is an incidental finding due to intersubject differences or to some other unidentified factor (i.e., greater subjective responsiveness to relaxation training as a result of increased sessions of inactivity).

Overall, substantial increases in EEG alpha and theta activity were not found for Subjects 1, 2, and 3 (see Figures 3 and 5). However, high baseline levels of median EEG alpha were exhibited by these three subjects, ranging from 49.9% to 67.75% (see Figure 3). According to Brown (1977), normal adults produce an average amount of EEG alpha activity from 35 to 75 percent of the time when the eyes are closed and approximately 20 percent of the time when the eyes are opened. No systematic data were collected in the present study on whether or not the eyes of the subjects were open or closed; however, informal observations made through the one-way window indicated that frequently the eyes of the subjects were closed. Therefore, it is assumed that Subjects 1, 2, and 3 were producing average amounts of EEG alpha activity throughout the study.

Due to the paucity of information available on EEG theta activity with children, it is difficult to interpret the mixed results found for Subjects 1, 2, and 3. However, these three subjects showed comparable theta activity levels, ranging from 21.35 to 35.75 median percent during baseline, and from 20.8 to 26.3 median percent during relaxation training.

It has been reported (Henry, 1944) that the alpha frequency in the majority of children stabilized at close to 8 years of age at about 9-11 Hertz. Mavor (1977) has also reported that normal EEG alpha activity in an awake 6 year

old child with eyes closed is somewhat regular at 8-9 Hertz, although there is a wide range of normal variation in children. It would appear that the EEG alpha activity frequency range selected for recording in the present study was appropriate according to the studies cited. Mavor (1977) has indicated that the bursts of rhythmic slow waves (3-5 Hertz) are normal and common during drowsiness or with arousal for children up to 10 years of age, and that EEG theta activity diminishes in amplitude and amount in the second decade of life. Since all three subjects (S1, S3, and S3) showed comparable alpha activity and theta activity, and these children were fairly close in age, it is speculated that they were producing average EEG theta activity.

All three subjects in Experiment I (taped relaxation training) demonstrated negligible (less than 5%) median increases in finger skin temperature (see Figure 6). Increased finger skin temperature has been reported to be related to reduction of physiological tension in adults (Stoyva & Budzynski, 1975; Green et al., 1970; Newton, Paul & Bovard, 1957), and to have a converse relationship with decreased frontalis EMG levels (Stoyva & Budzynski, 1975). Braud (1978) has reported increases in skin temperature (as measured by differences between finger and forehead temperature) in association with frontalis EMG decreases for school-aged children participating in both biofeedback and relaxation training. Braud did not report the actual

skin temperatures of the subjects included in that study so it is difficult to make direct comparisons with subjects included in this experiment. Additionally, as discussed earlier, Braud reported group data for six monitoring periods. Taub and Emurian (1976) have reported that normal hand temperature values for adults at rest range from 85° to 93° Fahrenheit when the ambient environmental temperature is in the low to mid-70s. Another investigator (Boudewyns, 1976) found that at rest finger temperatures for normal adults were lower in winter months than in warmer months even when taken under the same controlled conditions. Boudewyns also found that male subjects had higher finger temperatures than female subjects in the warmer months. Normal finger temperatures reported for males in the warmer months (April, May, and June) ranged from 86° to 95° Fahrenheit for 40 of the 44 subjects tested. Since Subjects 1, 2, and 3 were males and they participated in this experiment during the same months designated by Boudewyns as warmer months, it is reasonable to assume that these subjects were exhibiting normal finger skin temperatures during the baseline and the relaxation training condition. Subjects 1, 2, and 3 exhibited temperatures higher than those reported by Taub and Emurian (see Figure 6), but within the ranges reported by Boudewyns. It may be that differences in temperature ranges reported by these investigators reflect differences in methodology in data collection. It is also

speculated that normal child finger skin temperatures may be higher than adults because of maturational differences in the contraction and dialation of the blood vessels.

Increases in finger skin temperature for Subjects 1, 2, and 3 from the first 5 minute to the last 10 minute time periods only ranged from .06% to 2.3%. This finding indicates that the initial 5 minute time periods were of sufficient duration to allow for stabilization of finger skin temperature. Taub and Emurian (1976) have indicated that 4 minute stabilization periods were needed for subjects prior to the measurement of hand skin temperature because of previous findings of wide intrasubject fluctuation of hand skin temperature at the beginnings of sessions and also high intersubject stabilization time differences. Boudewyns (1976) has also reported that it was necessary to establish a 3 minute stabilization period preceding measurement of finger temperature.

The third purpose for this study was to determine whether taped relaxation training resulted in a reduction of hyperactive behavior exhibited in classroom and home settings. There were no indications that relaxation training resulted in systematic hyperactive behavior decreases for Subjects 1, 2, and 3 in either the home or the classroom settings (see Figure 8 and Tables 2 and 3). This finding is not surprising since there were no apparent effects in the laboratory setting to suggest that subjects had learned to

decrease physiological tension in that setting. However, it was interesting to find that, overall, classroom and home observations tended to support the pretraining behavior ratings of parents and teachers, that is, high baseline levels of the nine behaviors specified as hyperactive (see Appendix E) were observed in both settings along with high parent and teacher behavioral ratings.

#### Experiment II: Backwards Tape Presentation

The second purpose for this study was to determine whether reduced levels of physiological tension were achieved by children who were identified as hyperactive as a result of the backwards presentation of the relaxation training tape used for Subjects 1, 2, and 3. The results do not indicate that the backwards tape presentation was effective in producing physiological tension reduction for Subjects 4, 5, and 6 with respect to any physiological events monitored.

Two of the three subjects (S5 and S6) showed increases in frontalis EMG of a relatively small magnitude during the backwards tape presentations while one subject showed a slightly higher decrease in frontalis EMG. This finding indicates that irrelevant or nonsense tape content is not likely to result in frontalis EMG reduction. Although the frontalis EMG reductions were of small magnitude for Subjects 1, 2, and 3 in the first experiment, there was more of

an effect of frontalis EMG reduction for those subjects than for Subjects 4, 5, and 6. It can be seen in Figures 1 and 2 that Subjects 1, 2, and 3 showed frontalis EMG increases during baseline from the initial 5 minute time periods to the 10 minute time periods at the end of the sessions. However, during relaxation training, there was a reduction in frontalis EMG from the first 5 minute time periods to the 10 minute time periods after the relaxation tape. Subjects 4, 5, and 6 did not show decreases in frontalis EMG for the backwards tape presentation (see Figures 9 and 10). Thus, the changes seen for Subjects 1, 2, and 3 seem to be due to tape content.

Other investigators (Putre, Loffio, Chorost, & Marx, 1977) have reported that listening to adventure story tapes was as effective as listening to and following taped relaxation instructions for identified hyperactive boys between 7 and 13 years of age in the reduction of frontalis EMGs. Putre et al. (1977) have suggested that their findings indicate that special relaxation tapes may not be effective (and not that story tapes have a special advantage). It should be noted that the interpretations of the Putre et al. study reflect a group study, that the study was conducted only over a two week period, and frontalis EMG microvolt baseline levels for both groups were under 2.75 microvolts (which decreased to between 1.75 and 2.0 microvolts following treatment). Stoyva and Budzynski (1975) have indicated that



frontalis EMG microvolt levels below 3.0 microvolts show relaxed musculature in adults. Therefore, the subjects in the Putre et al. (1977) study seem to have been relaxed musc-  
larly during baseline. Incidentally, Stoyva and Budzynski's finding is also pertinent to subjects in the present study. Paul and Trimble (1970) also reported, however, that taped relaxation instructions were not as effective in producing relaxation as live training. Braud (1978) found effects on decreases in frontalis EMG levels similar for taped relaxa-  
tion instruction as for biofeedback training. Methodological problems of this study have already been discussed. How-  
ever, since there was an adult present throughout taped re-  
laxation training, it could be speculated that it was the "live" assistance on relaxation exercises that contributed heavily to the findings reported by Braud (1978). It  
appears that more research is needed with children to deter-  
mine the importance of tape contents in relaxation training and also taped relaxation training versus "live" training.

Subjects 4, 5, and 6 exhibited baseline levels of EEG alpha activity at or above adult normal levels (Brown, 1977). As found for Subjects 1, 2, and 3, these three subjects (S4, S5, and S6) frequently appeared to have their eyes closed during sessions when observed informally through the one-way window. All six subjects in these experiments pro-  
duced median EEG alpha that was within normal adult ranges



(Brown, 1977) across all sessions so any interpretation of results obtained would seem to be highly speculative.

Subjects 4, 5, and 6 showed individual patterns of EEG theta activity (see Figure 13), which was also seen for Subjects 1, 2, and 3. It was found that four of the six subjects in both experiments (S2, S3, S4, and S5) all showed EEG theta activity decreases across conditions during the initial and final time periods. Since EEG alpha activity did not increase commensurately, it can be assumed that these four subjects were producing brain wave activity about 12 Hertz as EEG theta activity decreased (since the subjects were not asleep during sessions). Lubar and Shouse (1977) have proposed that excessive overactivity in hyperkinetic children reflects the overcompensatory behavior of low CNS arousal states (the production of high 4-7 Hertz brain activity). These investigators reported that training low arousal subjects to inhibit the 4-7 Hertz EEG activity and to increase 12-14 Hertz EEG activity (SMR or sensorimotor rhythm that is recorded over the sensorimotor cortical brain areas) through EEG feedback increased the effects of stimulant medication in the control of certain hyperactive behaviors, and SMR training maintained the behavior improvement without stimulant drugs. Lubar and Shouse found that motoric (i.e., less undirected activity, increased in-seat behavior in the classroom) and oppositional behavior improved, but no changes were found for attentional deficit

behavior. Pretraining behavioral and questionnaire data had indicated high levels of the behaviors that improved through training; attentional deficit behavior had not been a high level behavior. The report of Lubar and Shouse is cited because they had their associates appear to be the only investigators interested in the influence of EEG theta activity on child behavior. Lubar and Shouse caution that their results are tentative since all subjects did not respond to training and because of the heterogeneous population of hyperactive children. However, their findings may be tangential to the findings in this study of decreased EEG theta for Subjects 2, 3, 4, and 5; similar behavior improvement to that reported by Lubar and Shouse was not seen for these subjects.

Finger skin temperatures were found to be within normal adult ranges for Subjects 4, 5, and 6 (see Figures 14 and 15) throughout baseline, backwards tape presentation, and relaxation training sessions. This assumption is based on the reports already discussed under Experiment I (Taub & Emurian, 1976; Boudewyns, 1976).

The third purpose for this study was to determine whether the backwards presentation of the relaxation training tape resulted in a reduction of hyperactive behavior exhibited in classroom and home settings. Classroom and home observational data for Subjects 4, 5, and 6 revealed that these subjects exhibited high baseline levels of hyperactive

behavior specified for observation (see Figure 16); similar levels of baseline observed behaviors were seen in both the home and classroom settings. Overall, these high levels of observed behaviors did not change appreciably from baseline sessions to the backwards tape presentation sessions (even though one subject showed a small decrease in hyperactive behavior in conjunction with the treatment), indicating that exposure to an irrelevant or nonsense tape had no effect on hyperactivity. Since there were no treatment effects on physiological tension change in the laboratory setting, there was no reason to expect any significant changes in hyperactivity in the natural environment.

#### General Discussion

Cantwell (1975) and Ross and Ross (1976) have suggested that the term hyperactivity refers to a heterogeneous population of individuals who manifest unique profiles of behavior. The findings for the subjects included in the present study tend to support this view. Each of the six subjects exhibited idiosyncratic profiles on the physiological variables and specified hyperactive behaviors, i.e., mean session frontalis EMG and EEG alpha activity, differences between the initial 5 minute and the final 10 minute time periods, range of session mean frontalis EMGs, frequency and different hyperactive behaviors observed in home and classroom settings. For example, S1 was eligible for

participation in the study because of the high scores received on the behavioral rating form from parent and teacher, and behavioral observations made during the baseline sessions and the relaxation training sessions supported the parent/teacher ratings. Yet, this subject exhibited the lowest consistent frontalis EMG microvolt levels throughout the present study of all of the six subjects, and, consequently, showed the least reduction in frontalis EMG of the three subjects included in the relaxation training condition. Conversely, S3, who exhibited a greater decrease in frontalis EMG in conjunction with relaxation training, was observed to demonstrate the lowest frequency of hyperactive behaviors of the six subjects in both the classroom and home settings.

Despite the fact that the six subjects showed idiosyncratic behavior and physiological patterns when compared with each other, intersubject commonalities were found in the present study. All subjects exhibited EEG alpha activity and finger skin temperatures at comparable levels, and finger skin temperatures also tended to increase across conditions. Additionally, no systematic changes in hyperactive behaviors observed occurred in either the home or the classroom settings.

The findings in the present study do not support the findings of other investigators (Braud, 1978; Lupin et al., 1974) that muscular tension is reduced significantly for hyperactive children as assessed by frontalis EMG as a

result of taped relaxation training, or that, as a consequence, hyperactivity is decreased in natural settings. Further research is needed to answer a number of questions raised by the findings of this study and findings from the few other studies in this area.

Future research efforts need to be directed toward determining how to select subjects from the heterogeneous population of hyperactive children who might best respond to relaxation training. Although, at the present time, hyperactivity is a behavioral diagnosis (Cantwell, 1979), it was seen in this study that high levels of hyperactive behaviors did not correlate with high physiological tension, particularly muscular tension. In some of the reports cited earlier in this paper, a wide variation of baseline levels of frontalis EMG, as an indicator of physiological tension, were found for children labeled hyperactive. It would be useful if a baseline criterion were to be determined as a screening measure of physiological tension in addition to observed and reported hyperactive behaviors. This would allow one to classify a homogeneous group among the heterogeneous population.

Research also should be directed toward determining what the best physiological indicators of physiological tension are for children. From the results of the present study, some physiological indicators used to determine physiological tension in adults (i.e., finger skin

temperature) do not appear to be useful with children. Perhaps autonomic tension levels in children do not correlate similarly with muscular tension as they seem to in adults. Or, it may be that the physiological indicators are appropriate for children, but the parameters of the indicators are different. Basmajian (1976) indicated that frontalis EMG is a useful rough indicator of general muscular tension. However, there is no generally accepted criterion for frontalis EMG change to indicate "significant" reduction. Stoyva and Budzynski (1975) suggest that muscular relaxation is present when frontalis EMG is below 3 microvolts for adults. Is this also true for children? Are there other body areas which should also be monitored for children in addition to frontalis EMG to substantiate tension reduction?

If relaxation training is to be provided, assuming that hyperactive children are located with high physiological tension levels, what kind or kinds of relaxation procedures would be most effective and most practical? Is live relaxation training more effective than taped relaxation? According to Paul and Trimble (1970), a review of a number of studies and data from their study indicated that live relaxation training is more effective for adults than taped relaxation training. Is this so for children? Braud (1978) used an adult assistant at all relaxation training sessions to assist subjects to correctly perform the relaxation exercises. Did this account for the significant findings

reported? A visual inspection of the frontalis EMG mean session data in the present study (see Figures 2 and 10) shows mean session decreases for EMG on the first relaxation training session (when the experimenter was present to assist subjects in the exercises) from the last baseline session for all subjects; however, the magnitude of decrease is quite small for Subjects 4 and 5. The lack of physiological tension reduction found for subjects in the present experiments cannot be accounted for by lack of compliance on the part of the subjects. In fact, all six subjects were observed to be engaging in the taped relaxation instructions throughout training, and physiological data recorded during training also indicated subject participation (i.e., fluctuation in frontalis EMG). It is interesting to note that, while engaged in relaxation exercises, subjects did not pull at sensor wires or appear restless; however, the subjects who listened to the backwards tape presentation did pull at wires on occasion or showed other restless behaviors (i.e., wiggled the headband up and down by manipulating forehead muscles).

Whether or not the presence of an adult assistant during relaxation training is meaningful can only be answered by further research that controls for this variable. There are also other questions that need to be answered with respect to relaxation training. How many sessions of relaxation training with children would be optimal to produce



maximum effects for reduction of frontalis EMG, or to demonstrate that generalization across training sessions has occurred? Such information would be necessary before looking for generalization to other locations outside of the training area. Are the number of baseline sessions related to progress in relaxation training? This would be an important question in single subject research on relaxation training. Should relaxation training be offered in settings outside of a laboratory setting? If so, how would changes in physiological tension be monitored? Hughes et al. (1980) reported decreases in frontalis EMG as a result of combined biofeedback training and reinforcement in classroom settings. The findings from this study suggest that it is feasible to monitor frontalis EMG in natural settings. Although Hughes et al. (1980) found that combining reinforcement procedures with biofeedback training enhanced frontalis EMG decreases, there have been no reports of controlled studies combining reinforcement procedures with relaxation training. This could be an interesting approach. As discussed earlier, there is still a question on the importance of tape content as a variable in taped relaxation training that warrants further investigation. How could practice change the effectiveness of taped or live relaxation training? Jacobson (1962) has emphasized that daily practice of relaxation exercises by adults is necessary if mastery of relaxation is to



be achieved. How much practice would be optimal for children? Over what period of time should relaxation training be offered to children? Jacobson (1962) has suggested that it may take weeks, months, or years for adults to demonstrate complete relaxation from a state of physical tension within a matter of minutes. Jacobson's adult general relaxation training program, as modified by Wolpe (1969), covers a period of about 10 weeks. In autogenic training for relaxation, it is expected that relaxation skills are not acquired for weeks or months (Luthe, 1971). Future research should take into account the need for more sessions if one is to expect changes in accordance with previously published findings. In the pilot work conducted by Striefel (1977-78), subjects participated in taped relaxation training throughout the school year, or for approximately nine months; this may have contributed to the changes in frontalis EMG seen for Striefel's subjects discussed earlier in this section.

The reliability of behavior rating scales is another issue that needs to be addressed by investigators utilizing behavioral rating scales to identify hyperactive children and to monitor behavioral changes that may occur as a result of relaxation training. Ross and Ross (1976), in reviewing the most widely used behavioral rating scales selected by investigators and practitioners in the hyperactivity area, concluded that items included on most of the rating scales reviewed were not operationally defined, response choices

were open to questions, and items included on some scales were not included on others. O'Leary (1980) has reported that the Conners Teacher Rating Scale (Conners, 1969) continues to be one of the most frequently selected scales for use in determining hyperactivity and hyperactive behavior change by various investigators even though this scale is open to qualitative judgments on the part of the user. O'Leary has also discussed the overlap between aggressive conduct behaviors with hyperactive behaviors (i.e., attentional deficits, impulsive behavior). The aggressive conduct/hyperactivity dichotomy may be further compounded when pre-post behavioral ratings are used to substantiate generalization effects of relaxation training.

Perhaps the practicality of relaxation training as a viable treatment approach for children identified as hyperactive would be clearer if an ideal study could be conducted which would attempt to control some of the variables that have been discussed. Ideally, this study would be conducted over a several months period. Subjects would be screened on a criterion frontalis EMG level in addition to behavioral observation data on behaviors that appear to relate to hyperactivity, excluding aggressive conduct behaviors. Both live and taped relaxation training would be compared to determine the effectiveness of each technique in the reduction of frontalis EMG levels. The initial 5 minute session

time periods would be used to gauge whether or not relaxation training effects were seen across time. Daily classroom and home practice sessions would be conducted and monitored by trained observers; home practice tapes would be varied to avoid a boredom factor. Parent and teacher ratings would be obtained periodically during baseline and treatment to determine whether there were correlations between subjectively reported behavior changes and actual objective observations of behavior changes. Finally, operationally defined hyperactive behaviors would be observed in home and school settings in order to ascertain any generalization effects in the environment. The results of such a study could help to resolve some of the many questions raised in this paper.

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## APPENDICES

Appendix A

Referral Source Behavior Rating Scale

## BEHAVIOR RATING SCALE

Child's Name \_\_\_\_\_ Birth Date \_\_\_\_\_

Rater's Name \_\_\_\_\_ Date of Rating \_\_\_\_\_

Please circle the appropriate description on the scale that indicates your estimate of the degree to which you observe these behaviors displayed by the child.

As you make each rating, try to compare the child's behavior with that of other children you know of the same sex and age. That is, the rating should indicate your estimate of the child's behavior in comparison with the behavior of most children. It is not necessary that the child you are rating display all of the behavioral examples given after each main heading; we are interested in your general estimate of the main category headings.

1. Motor Activity Level - Constant overactivity; advance motor development (walking, running, throwing things, etc.); always on the move; rather run than walk; rarely sits still

Much Less Than Most Children	Less	Slightly Less	Slightly More	More	Much More Than Most Children
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2. Short Attention Span and Distractibility - Concentration on a single activity is usually short, with frequent shifting from one activity to another; rarely sticks to a single task very long; is easily distracted

Much Less Than Most Children	Less	Slightly Less	Slightly More	More	Much More Than Most Children
---------------------------------	------	------------------	------------------	------	---------------------------------

3. Variability - Behavior is unpredictable, with wide fluctuations in performance; sometimes he (or she) displays very appropriate behavior and sometimes the opposite; quick mood changes

Much Less Than Most Children	Less	Slightly Less	Slightly More	More	Much More Than Most Children
---------------------------------	------	------------------	------------------	------	---------------------------------

4. Impulsiveness and Inability to Delay Gratification - Does things on the spur of the moment without thinking; seems unable to tolerate any delay in gratification of needs and demands; when wants anything, wants it immediately; does not look ahead or work toward future goals; thinks only of immediate present situation

Much Less Than Most Children	Less	Slightly Less	Slightly More	More	Much More Than Most Children
---------------------------------	------	------------------	------------------	------	---------------------------------

Page 2

## Behavior Rating Scale

5. Irritability - Frustration tolerance is low; easily upset if everything does not work out just the way child desires

Much Less Than Most Children	Less	Slightly Less	Slightly More	More	Much More Than Most Children
---------------------------------	------	------------------	------------------	------	---------------------------------

- 
6. Explosiveness - Fits of anger are easily provoked; reactions intense; emotional outbursts; temper tantrums

Much Less Than Most Children	Less	Slightly Less	Slightly More	More	Much More Than Most Children
---------------------------------	------	------------------	------------------	------	---------------------------------

- 
7. Repetitive Behavior Patterns - Displays patterns of nervous activity such as hair twisting, finger tapping, foot movements, body rocking

Much Less Than Most Children	Less	Slightly Less	Slightly More	More	Much More Than Most Children
---------------------------------	------	------------------	------------------	------	---------------------------------

- 
8. Tenseness - Appears uptight and anxious, can't seem to relax, worries about a number of things

Much Less Than Most Children	Less	Slightly Less	Slightly More	More	Much More Than Most Children
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Appendix B  
Letter to Parent  
Parent Consent Form



UTAH STATE UNIVERSITY · LOGAN, UTAH 84322

UNIVERSITY AFFILIATED  
EXCEPTIONAL CHILD CENTER

Dear Parent:

We would like to obtain permission to include your child in a research project concerned with teaching children to modify their overactive behavior. This letter is to explain what the project is about and how it is to be conducted. We will be pleased to answer any particular questions you may have concerning the project. You may feel free to contact Phyllis Cole at 752-4100, extension 8273. We are enclosing a permission slip which when signed will allow your child to participate in the project.

The purpose of this project is to determine the usefulness of a systematic cassette taped training program to teach overactive children to relax. Relaxation training has been used successfully with both adults and children for various types of problems, and we are interested in learning if this approach will benefit children who are overactive or have been diagnosed as hyperactive.

Children will be brought to the Exceptional Child Center three times each week for thirty-five minute periods. Transportation will be provided to and from your home. During the thirty-five minute periods recording sensors will be attached to the child by easily removed tape to provide information about how tense or relaxed the child may be. We will also be observing the child's behavior in the classroom and home for one-half hour periods on two days each week. The home observations will be arranged at times of your convenience.

There will be no financial cost for parents whose children are involved in the project. The exact times for sessions in the training area and observation will be worked out with families and teachers of individual children to minimize any inconvenience for them. To date, there have been no reports of negative or aversive effects reported by others receiving or providing this type of training. Should a child decide that he does not wish to participate in the project at any time, even though parental permission has been obtained, project participation will be terminated.

We are vitally concerned with maintaining the personal confidentiality of each child. To this end, no children will be identified by name on any results of the project, rather they will be identified by a code; thus assuring confidentiality. In addition, the data on individual children will not be available to persons not directly concerned with the project. We will be available throughout the project to discuss it with you at any time.

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If you have no questions, and you feel that you would like your child to participate in the project as outlined above, please sign the permission slip enclosed and return it in the enclosed self-addressed envelope. After receiving the signed permission slip, we will contact you to discuss the individual scheduling arrangements for your child. If you decide not to allow your child to participate, we would appreciate your signing the permission slip accordingly and returning it in the self-addressed envelope.

Sincerely,

Sebastian Striefel, Ph.D.  
Director, Division of Services

Phyllis Cole  
Project Coordinator

SS:PC/mh  
Enclosures

### PARENTAL PERMISSION

I have read the letter outlining the purposes and procedures of the project concerned with teaching children to modify their overactive behavior and hereby give my informed consent as parent or legal guardian of

\_\_\_\_\_ to participate  
(child's name)  
as a subject in this project being conducted at the  
Exceptional Child Center.

(Date)

(Parent's signature)

\* \* \* \* \*

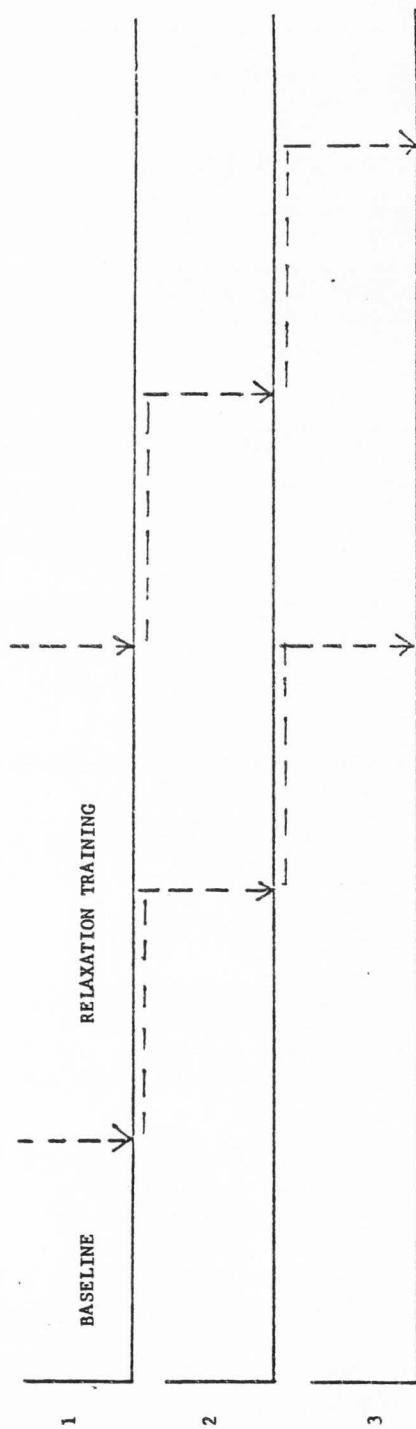
I do not give my permission for \_\_\_\_\_  
(child's name)  
to participate in the project as outlined.

(Date)

(Parent's signature)

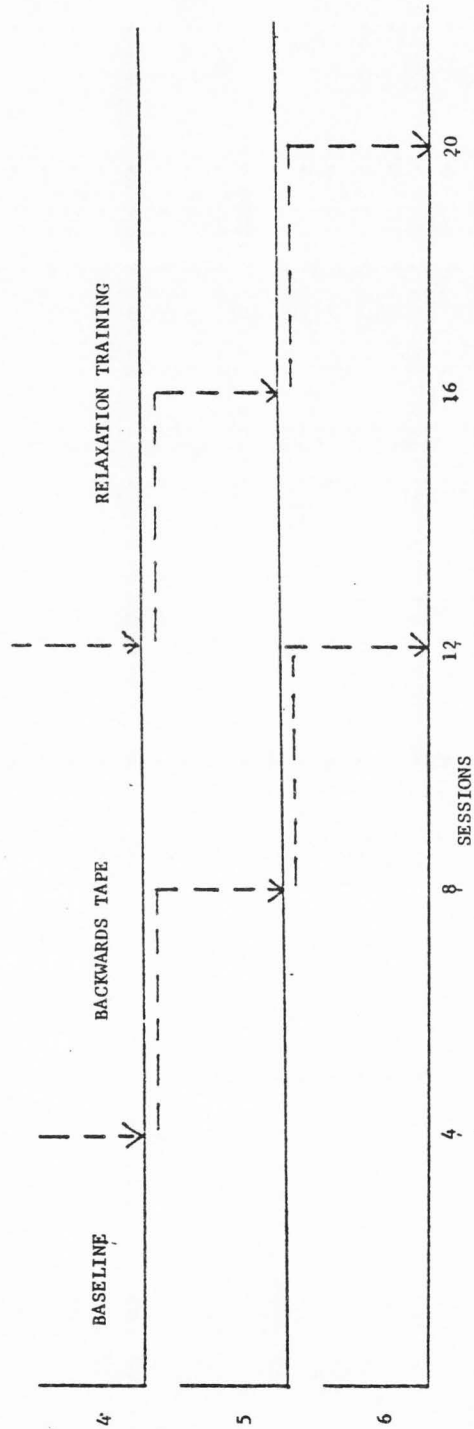
Appendix C

Design for Experiments I and II



SUBJECTS

### EXPERIMENT I



SESSIONS

### EXPERIMENT II

Appendix DPhysiological Recording Data Sheet





Appendix E

List of Behaviors to be Observed

## BEHAVIORS TO BE OBSERVED

- OS            Out of Seat --- Any situation in which the normal seating surface of neither buttock is in direct contact with the seat of the child's assigned chair, and where the child has not been given permission by the teacher to be removed from the seat. Examples: Walking around the room, standing in front of chair by assigned desk, lying across table or desk, standing with one knee on seat of chair, etc.
- SM            In Seat, Seat Not Stationary --- Any situation where the normal seating surface of either buttock is in direct contact with the seat of the child's assigned chair, but where the position of the chair is altered from its usual stationary position in contact with the floor. Examples: One or more of the chair legs is off the surface of the floor, the chair is being slid over the floor, the chair leg(s) are resting on the child's foot or feet, etc.
- PB            In Seat, Inappropriate Head, Leg(s), or Body Position --- Any situation where: (1) the normal seating surface of either buttock is in direct contact with the seat of the child's assigned chair but the head or body is turned in excess of 89 degrees, using the desk or table as a reference point, or (2) some part of either buttock is in contact with the surface of the seat of the chair but one or two legs or feet are contacting the chair seat. Examples: Head is turned parallel with shoulders, child is looking at something or someone to his rear, one foot is resting on the chair seat, both knees are bent and feet are touching the chair seat, child is sitting sideways on chair, head is tilted backwards so eyes are focused on ceiling, etc.
- BR            In Seat, Repetitive Body Movements --- Any situation where the normal seating surface of either buttock is in direct contact with the seat of the child's assigned chair, but more than one movement or movement pattern is made by the torso, shoulders, and head, either alone or together, or any situation where the buttocks are in movement while still contacting the seat of the chair partially. Examples: Twisting upper part of body from side-to-side, rocking body back and forth, head is moving from side-to-side, wiggling or squirming, shrugging of shoulders up and down, rubbing of buttocks across the seat of the chair, etc.
- HM            Repetitive Hand, Finger, or Arm Movements --- Any situation where more than one movement or movement pattern is made by arm(s), hand(s), or finger(s) alone or together, or in contact with an object. Examples: Clapping hands together inappropriately, hair twisting, repetitive finger contact and removal from surface of desk (tapping), stretching rubber band in and out, swinging arms, repetitive finger contact and removal of cheek, repetitive pencil contact and removal from surface of desk or table, etc.

- FM            Repetitive Leg or Foot Movements --- Any situation where more than one movement or movement pattern is made by either leg(s) or foot(feet) either alone or together, or in contact with another object. Examples: Foot tapping (repetitive foot contact and removal from surface of floor), foot shuffling, kicking of furniture, twisting foot back and forth, jiggling leg or legs up and down or sideways, swinging legs back and forth, wiggling thighs, etc.
- AV            Vocalization --- Any audible respiratory noise or vocalization made without teacher permission, and which is not involuntary (e.g., sneezing, single cough, multiple coughing when connected with a head cold). Examples: muttering, whistling, humming, talking to other children without permission, swearing, screaming, laughing at loud intensity, coughing repetitively when child does not have a head cold, calling teacher's name for attention, etc.
- CP            Inappropriate Direct or Indirect Physical Contact With Another Person --- Any instance where the child inappropriately physically contacts another person with the hands or feet that is either initiated or reciprocated, or any instance where an object is used inappropriately to make physical contact with another person. Examples: Throwing an object at another child, holding a book to hit another person, putting out foot to trip another person, hitting, kicking another child, etc.
- NO            Inappropriate Direct Physical Contact With Objects Producing Audible Noise, Single Instance --- Any instance of direct hand or finger or foot contact with an inanimate object that is not repeated more than once which results in an audible noise. Examples, Slamming desk lid closed, throwing a book on the table, kick of the desk, grabbing object or work from another child's desk, lifting desk from floor either partially or totally and allowing it to fall, slamming door of room, etc.

Appendix FObservational Behavior Data Sheet

OBSERVER:

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Appendix G

Relaxation Training Script

## RELAXATION TRAINING SCRIPT

I would like you to listen to this tape and to do the things I tell you to do. I want you to learn what it feels like to be tense, and what it feels like to relax. So be sure to do what I tell you the best that you can. First, make your hands into tight fists. Make your fists as tight as you can, and keep your fingers squeezed tightly together. Feel how tight they are. It may hurt a little because you are squeezing your fists so tightly. That feeling of tightness is called tension. Now, let your hands open slowly, very slowly, so that your fingers are spread apart and your hands are resting beside you. How different your hands feel when they are not shut up tightly into fists. They feel relaxed, nice and pleasantly relaxed. Once again, make tight fists with your hands. Squeeze the fist tighter and hold them tight while I count to five. One, two, three, four, five. Now, let go, let your hands slowly open and your fingers spread apart. Let your hands rest and relax. It feels good to relax your hands. Now, stretch both your arms and hands straight out in front of you as far as you can. Point your fingers as if you were trying to touch the wall in front of you. Stretch your arms more, way out, hold them. Now, let them fall gently and slowly to your sides. Let them relax beside your body. There is a difference in how your muscles feel when you tense them or relax them. Tension makes them hurt. Relaxing them makes them feel good. Stretch your arms again straight out in front of you as far as you can. Make your fingers reach toward the

wall. Hold them there until I count to five. One, two, three, four, five. Now, let them relax and fall gently back to where they were. Let your arms and hands rest and relax beside you. With your legs straight out in front of you, point your toes toward your nose. Try to point your toes toward your nose as far as you can. Hold them there while I count to five. One, two, three, four, five. Now, let your toes relax and go back to where they were. Rest them and relax. When your toes were pointed toward your nose, the muscles in your legs were tense and tight. They are relaxed now. Once again, point your toes toward your nose. Hold them pointed toward your nose as far as you can. Relax, and let your toes go back to where they feel comfortable. Let them rest and relax. Now, point your toes the other way so they are trying to touch the floor. Point them down toward the floor as far as you can. Keep pointing toward the floor while I count to five. One, two, three, four, five. Now, let go. Let your toes relax and rest the way they were before you pointed them toward the floor. Relax and rest. Again, point your toes toward the floor as far as you can. Feel how tense your legs and toes are. Hold them there tightly. Now, let your toes and feet relax and rest. Relax your toes more and more. Now, I would like you to take a deep breath. Breathe in. Hold it. Now, slowly let your breath out. Let your breath out so that you feel relaxed. Once more, take a deep breath and hold it while I count to five. One, two, three, four, five. Let your breath out slowly until you feel so relaxed. Rest and feel how good it is to relax. Wrinkle up your face. Squeeze your eyes very tightly together. Squeeze them even tighter. See if you can make your mouth all wrinkled up, too.



Wrinkle up your face tight. Now, let your face relax. Let all the wrinkles go away. Let your mouth and eyes relax, not tight, just relaxed. One more time, squeeze your eyes tightly together. Wrinkle up your face very tightly. Hold it while I count to five. One, two, three, four, five. Now, let go. Let all the wrinkles go away as you relax your face. Your eyes and mouth feel relaxed. Your forehead feels smooth without wrinkles. How nice it feels to have your face relaxed. Rest and relax. Bend your head so that your chin is trying to touch your chest. Bend your head toward your chest as far as you can. Your chin will touch your chest. Hold your chin on your chest while I count to five. One, two, three, four, five. Now, let your head rest back as comfortably as you can. Relax your head and rest. How good it feels. Pull your shoulders up toward the top of your head. Bring your shoulders up higher so that your head is tucked in between your shoulders. Tuck your head in between your shoulders as far as you can. Hold your shoulders up around your head until I tell you to let go. Now, let go, relax and let your shoulders fall gently back the way they were. Let your head and your shoulders relax. Relax more and more. Take a deep breath. Hold it. Now let your breath out slowly, slowly. Once again, take another deep breath. Hold it. Hold it. Let it out very slowly, so slowly, and relax. Relax more and more. Your arms and hands are resting and relaxed beside you. Your legs and feet are resting comfortably, so relaxed. Your face is smooth and not wrinkled. It is relaxed and smooth. Your shoulders and head are relaxed, feeling so good and so relaxed. It feels good to rest, to relax, and rest your muscles. Now, I would like you to just rest quietly for a little while longer.

## VITA

Phyllis L. Cole

Candidate for the Degree of

Doctor of Philosophy

Dissertation: The Effects of Taped Relaxation Training on  
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of Hyperactive Children

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1975-76.

Auditor (Title III Projects), Utah State Board of  
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Research Associate, Department of Psychology,  
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